FEASIBILITY STUDY

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Response Measures Evaluation Report

PULVERIZING SERVICES SITE
MOORESTOWN, NEW JERSEY

Prepared For:

PPG INDUSTRIES, INC.

Prepared By:

ICF KAISER ENGINEERS, INC.

ICF KAISER

December 15, 1997

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ATTACHMENTS

LIST OF APPENDICES

Section I

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1.0 INTRODUCTION AND BACKGROUND

The United States Environmental Protection Agency (USEPA) entered into an Administrative Order on Consent (Order), Index No. II-CERCLA-80109. effective April 3. 1989. with PPG Industries. Inc. (PPG) for the Pulverizing Services Site (Site) located in Moorestown. New Jersey. Under the Order, PPG is required to identify response measures which appear feasible for mitigation of the soil and groundwater contamination at or emanating from the Phase II Remedial Investigation Study Area, and recommend the response measure which PPG deems to be the most appropriate for mitigation of the contamination.

This Response Measures Evaluation Report has been prepared to satisfy the requirements of the Order. This report focuses on the Site soils and disposal trench materials. while supplemental investigation would be required prior to addressing groundwater. PPG has contracted ICF Kaiser Engineers, Inc. (ICF Kaiser) to perform the Response Measures Evaluation (RME) as described herein.

1.1 PURPOSE AND APPROACH

The purpose of the RME is to develop and evaluate potential response measures which will mitigate potential human health and environmental risks associated with soils and trench materials at the Site. The response measures assembled for this report were assessed using USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation. and Liability Act (CERCLA), (USEPA, October 1988). This report provides the basis for response measure selection and documents the development and analysis of appropriate response measures for the Site.

1.2 SITE LOCATION AND HISTORY[1]

1.2.1 Location

The Pulverizing Services Site is comprised of approximately 24 acres located in an industrial park at 332 New Albany Road in Moorestown. Burlington County, New Jersey. A Site Location Map is presented as Figure 1-1. A Site Layout Map is presented in Figure 1-2. The Site is located 3/4-mile due east of the North Branch of the Pennsauken Creek. An unnamed creek is located approximately 3/4-mile due east of the Site. Land use immediately adjacent to the Site is comprised of commercial, light industrial, and residential areas as follows:

> <u>North</u> - The Site is bounded to the north by Crider Avenue, across which is located a manufacturing facility;
>
> <u>South</u> - The Site is bounded to the south by railroad tracks (owned by BB&O), across which are located several residences;

[1] Summarized from the <u>Phase II Site Investigation Report</u>. November 10. 1995. McLaren/Hart Environmental Engineering Corporation.

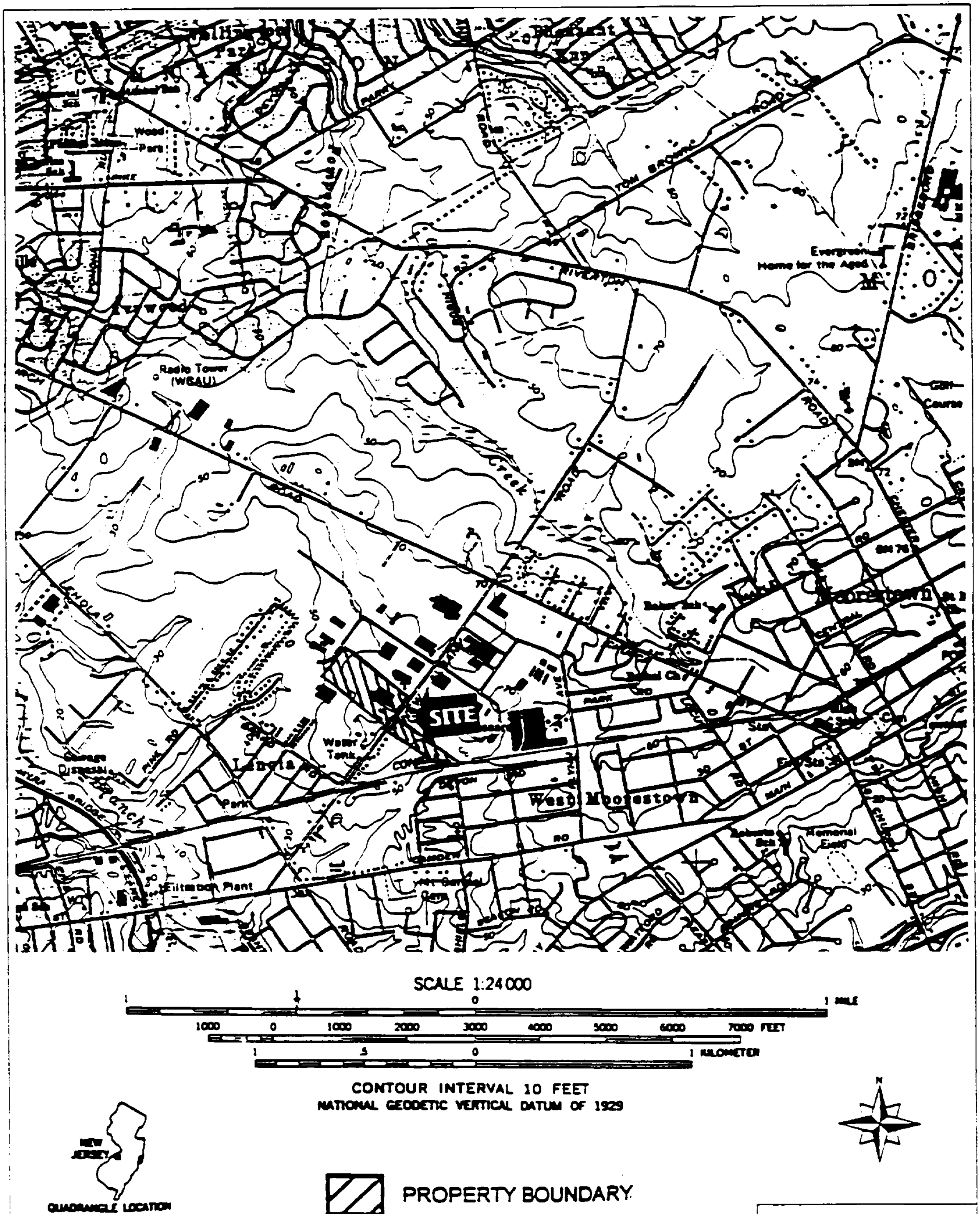
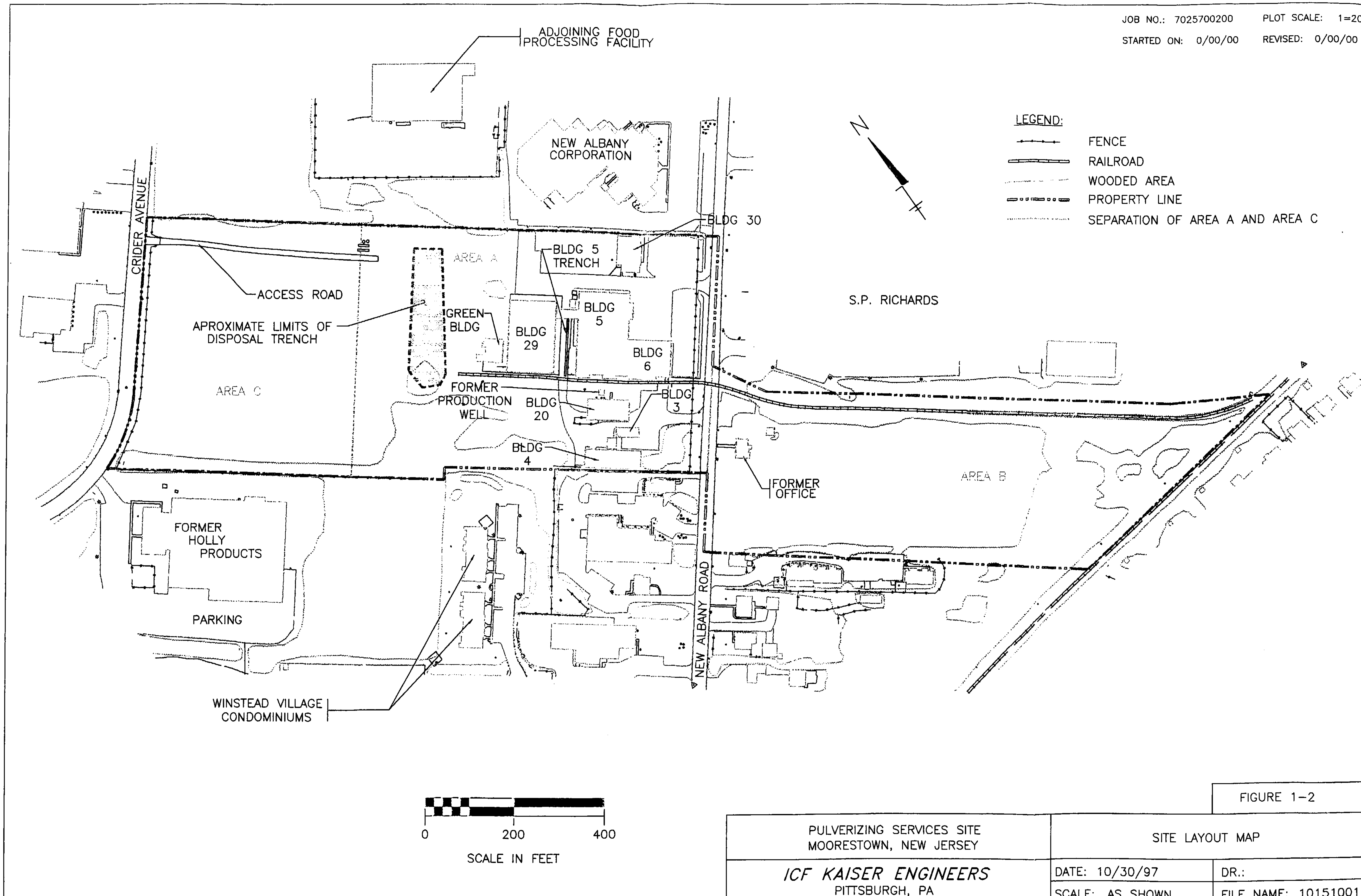


FIGURE 2-1

PULVERIZING SERVICES SITE MOORESTOWN, NEW JERSEY	SITE LOCATION MAP

ICF KAISER ENGINEERS PITTSBURGH, PA	DATE: 10/31/97	DR.: D. EVANS
	SCALE: AS SHOWN	FILE NAME: 10151005


JOB NO.: 7025700200
PLOT SCALE: 1=200
STARTED ON: 0/00/00
REVISED: 0/00/00
ADJOINING FOOD PROCESSING FACILITY
NEW ALBANY CORPORATION
LEGEND:
FENCE
RAILROAD
WOODED AREA
PROPERTY LINE
SEPARATION OF AREA A AND AREA C
N
CRIDER AVENUE
BLDG 30
BLDG 5 TRENCH
AREA A
ACCESS ROAD
APROXIMATE LIMITS OF DISPOSAL TRENCH
GREEN BLDG
BLDG 29
BLDG 5
BLDG 6
S.P. RICHARDS
AREA C
FORMER PRODUCTION WELL
BLDG 20
BLDG 3
BLDG 4
FORMER OFFICE
AREA B
FORMER HOLLY PRODUCTS
PARKING
NEW ALBANY ROAD
WINSTEAD VILLAGE CONDOMINIUMS
0
200
400
SCALE IN FEET
FIGURE 1-2
PULVERIZING SERVICES SITE
MOORESTOWN, NEW JERSEY
SITE LAYOUT MAP
ICF KAISER ENGINEERS
PITTSBURGH, PA
DATE: 10/30/97
DR.:
SCALE: AS SHOWN
FILE NAME: 10151001

East - The Site is bounded to the east by active industrial facilities: and

West - The Site is bounded to the west by active residential, commercial, and industrial properties.

The entire Site is subdivided into three parcels (Areas A, B, and C). One major roadway, New Albany Road, separates Area B from Areas A and C.

1.2.2 History

The Site is an inactive pesticide formulating facility. A summary of Site ownership is presented below.

- 1935 to 1946 - The plant was operated by the International Pulverizing Company;
- 1946 to 1948 - The plant was owned and operated by Micronizer Company, a subsidiary of Freeport Sulfur Company;
- 1948 to 1963 - The plant was owned and operated by PPG Industries, Inc.;
- 1963 to 1979 - The plant was owned and operated by Pulverizing Services, Inc. Operations reportedly ceased in 1979 due to labor problems; and
- 1979 to Present - The plant has been inactive and unoccupied.

During the operating period of the plant, operations were primarily limited to Area A and involved the grinding, micronizing, and blending of pesticides. According to historical reports, operations were initially limited to formulation of inorganic pesticides such as lead arsenate, calcium arsenate, sulfur, and tetrasodiumpyrophosphate. In later years, synthetic organic pesticides such as dichlorodiphenyltrichloroethene (DDT), aldrin, malathion, dieldrin, lindane, rotenone, and n-methyl carbamate (Sevin or Carbaryl) were reportedly formulated. The active pesticide ingredients were not manufactured at the Site, but instead were brought to the Site, ground, blended, and packaged for distribution under various labels.

Site literature (Pulverizing Services, Inc.) indicated that since 1935, only dry chemical processing was conducted at the Site. The services provided included the grinding (using fluid energy such as compressed air), densifying, packaging, warehousing, and distributing of products to support industries such as plastics, pharmaceuticals, and pesticides.

During the 1950's and early 1960's (USEPA, February 1988), waste material was reportedly disposed of to the north of the main production buildings in several trenches. In addition, historical project files indicate that a fire occurred in 1964. The ash and debris from the fire was reportedly placed in a trench north of the main production buildings in Area A.

Commercial operations at the plant ceased in 1979. Former plant production facilities within Area A were decommissioned (by removing interior facilities) and were boarded shut in 1983. The buildings are still present at the Site. In May 1988, security fencing was placed around Areas A and C. A removal of chemicals from within the Site buildings was performed under the direction of USEPA in 1990. In the spring of 1993, security fencing was installed around Area B. A limited removal of impacted surface soils occurred from adjacent properties in the Spring of 1996.

1.3 PHYSICAL SETTING

This section describes the physical characteristics of the Site, including the Site geology and hydrogeology.

1.3.1 Geology and Hydrogeology

Regional

Regionally, the Site is located in the Atlantic Coastal Plain Physiographic Province in a transition zone between the Englishtown Formation and the Woodbury Clay outcrop. The Site-specific unconsolidated sediments of the Coastal Plain include (oldest to youngest) the Magothy and Raritan Formation, Merchantville Formation, and the Woodbury Clay, which are all Cretaceous in age. Beneath the Site, bedrock (Wissahickon Formation [schist]) is estimated to be 450 feet below ground surface (bgs).

The primary stratigraphic unit underlying the Site is the Pennsauken Formation which is Pleistocene in age. The Pennsauken Formation is described as a red sand and is present at the facility from ground surface to approximately 10 to 20 feet bgs. At locations where the Pennsauken Formation is absent, the sand and sandy clay lenses of the Cretaceous Age Englishtown Formation are present. Both of the sand units terminate at the Woodbury Clay, which is encountered from approximately 10 to 20 feet bgs. The drilling log for the former production well at the Site indicates a combined thickness of the Woodbury Clay and the underlying Merchantville Formation of approximately 126 feet. These units are underlain by the Magothy and Raritan Formations, which begin with approximately 100 feet of a tough, blue clay prior to reaching the permeable unconsolidated materials (primarily sand and gravel), which begin at approximately 250 feet bgs.

The shallow unconfined unit, or water table aquifer, is located within a combination of the Quaternary sediments (Pennsauken Formation) and the thin or absent sand and clay of the Englishtown Formation. The water table is typically encountered between five to ten feet bgs.

Beneath the unconfined unit is the confining unit (clay). This unit is comprised of the Woodbury Clay which functions, along with the uppermost clay of the Magothy and Raritan Formations, as a confining unit between the aquifer of the Magothy and Raritan Formation. These clay units are interrupted by a ten foot sand layer (Merchantville Formation). Well drilling logs indicate that this confining unit is laterally continuous throughout this area of New Jersey. The combined thickness of the confining units including the Woodbury Clay, Merchantville Formation, and the Magothy and Raritan Formations is approximately 225 feet. The deep unconfined unit is composed of the sediments (predominantly sands and gravels) of the Magothy and Raritan Formations, which are overlain by the stiff clay within the same formation.

Site Geology

Site geologic conditions are generally consistent with those presented above. Based on the information obtained during the Phase I and Phase II Site Investigations, the Site contains the following subsurface units, in increasing order of depth:

- Surficial gray silty sand and clay (0 to 6 feet bgs);
- Red sand with gravel and some silty, sandy clay (0 to 18 feet bgs);
- Stiff blue clay with reddish brown staining (9 to 128 feet bgs);
- Gray sand (128 to 147 feet bgs);
- Tight, blue-gray clay (147 to 250 feet bgs);
- Coarse sand and gravel with silt and clay layers (250 to 318 feet bgs).

The surficial materials across the Site in Areas A, B, and C are observed to be natural sand with gravel and clayey sand/silt. Localized non-vegetated areas indicate the presence of other surficial material. In Areas B and C these non-vegetated areas are either gravel-filled access roadways or very small localized gravel/sand/debris piles. Area A is partially paved with concrete or asphalt roadways.

The clay unit underlying the upper sand appears to be laterally continuous throughout the Site. The unit is comprised of 95% silt and clay with a vertical hydraulic permeability of 9.1×10^{-9} centimeters per second (cm/sec), which is consistent with natural clay values reported in literature.

Site Hydrogeology

Site hydrogeology is primarily controlled by the presence of the surficial unit consisting of red sand and gravel with silt and clay-rich zones, the stiff, low-permeability clays, and the deep sands and gravels beneath the clay. These factors affect Site hydrogeology and result in the development of the following primary hydrogeologic units:

- An upper shallow unconfined unit (water bearing unit) located within the red sand and gravel with silt and clay-rich zones approximately 10 to 20 feet thick;
- A confining layer consisting of approximately 125 feet of an extremely low-permeability clay (9.1×10^{-9} cm/sec), followed by approximately 10 feet of a sand layer, and finally another 100 feet of very stiff clay; and
- A deeper (starting at approximately 225 feet bgs), more productive confined artesian groundwater unit consisting of sands and gravels, with no apparent hydrologic connection with the overlying unconfined unit.

Based on groundwater surface elevation measurements taken during the Phase II Site Investigation, there are two predominant groundwater flow directions emanating from Area A. One flow direction is to the northwest (with an average hydraulic gradient of 0.017 foot per foot[ft/ft]) and the other to the southwest (with an average hydraulic gradient of 0.005 ft/ft), both eventually discharging towards the North Branch of the Pennsauken Creek. These flow directions are consistent with those reported for the regional groundwater flow direction. The following seepage velocities were calculated in the Phase II Site Investigation Report:

Horizontal — Shallow Sand Unit

- Northwesterly and westerly flow directions = 0.05 ft/day; and
- Southwesterly flow direction = 0.01 ft/day.

Vertical — Shallow sand unit to deep sand and gravel aquifer

- 2.5×10^{-4} ft/day.

1.3.2 Surface Water Hydrology

The Site is relatively flat and generally well vegetated. It is generally drained by a system of surface swales that drain to a small creek which exits the Site near the northwestern boundary. In order to fully characterize the surface water hydrology, a Supplemental Phase II Site Investigation Work Plan was submitted to USEPA by PPG. A detailed surface water drainage evaluation will be performed as part of the Supplemental Phase II Site Investigation. The evaluation will focus on the drainage ditches along the north side of Areas A and C, the Building 5 Trench, and the stormwater discharge near New Albany Road. The evaluation will also consist of: 1) A review of available maps of the Site area to determine the probable drainage pathways and discharge points for surface water; 2) Interviews with appropriate Township and State engineers to obtain construction details associated with the recently updated (1991) municipal storm sewer system along New Albany Road; and 3) a Site reconnaissance to inspect potential Site surface water drainage pathways (stormwater culverts, drainage ditches, surface depressions, surface water bodies, etc.) and confirmation of the ultimate discharge point(s) of surface water.

A wetlands evaluation conducted by McLaren Hart on April 9, 1996 identified that wetlands were present at three locations at or immediately adjacent to the Site. The wetlands are located along the drainage swale in the western portion of Areas A and C, outside the northern perimeter fence in Area A, and at the southeastern most portion of Area B. More information regarding these wetland environments can be found in McLaren Hart's Wetlands Evaluation and Habitat Survey Report dated July 16, 1996.

1.4 CONTAMINATION ASSESSMENT

Since 1986, several environmental investigations have been conducted at the Site. These investigations have included soil, groundwater, sediment, surface water, and air sampling. The detailed results of these investigations are presented in the Phase I Site Investigation Report (Paul C. Rizzo Associates, Inc., August 1993) and the Phase II Site Investigation Report (McLaren/Hart, November 1995). The following section briefly describes the activities performed during each of the previous Site investigations.

- NJDEP Sampling - April 1986 - In April 1986, the New Jersey Department of Environmental Protection (NJDEP) investigated Area A and collected samples from the Site soils, sediment, surface water, and former production area building floors and drains. Samples were analyzed for metals, volatile organic compounds

(VOCs), semi-volatile organic compounds (SVOCs), dioxins, pesticides, herbicides, and polychlorinated biphenyls (PCBs).

- USEPA Sampling - October 1987 - In October 1987, the USEPA Technical Assistance Team (TAT) conducted an investigation at the Site. Samples were collected from soil, sediment, surface water, former plant structures, and air. The samples were analyzed for pesticides and herbicides. The detailed analytical results are presented in the Phase I Site Investigation Report.
- USEPA Sampling December 1987 - In December 1987, the USEPA Emergency Response Team (ERT) conducted an investigation at the Site. According to the sampling report, surface and subsurface soil sampling was conducted within Areas A, B, and C. Samples were analyzed for select metals (arsenic and lead), pesticides, herbicides, and PCBs. A ground penetrating radar (GPR) survey was also conducted during this sampling event. The GPR survey identified several areas of subsurface anomalies in Area A.
- Phase I Site Investigation Report - April 1993 - A Phase I Site Investigation was conducted at the Site from December 1989 to January 1990 by Paul C. Rizzo Associates, Inc. (PCR). A draft report was submitted to USEPA on May 25, 1990. This report was later revised to include additional information which had been collected, and was resubmitted in April 1993. During the investigation, 20 soil borings were completed, and six monitoring wells were installed within Area A. Several soil samples (both surface and subsurface) were collected from each boring. In addition, four surface soil samples were collected from the vicinity of the garage in Area B, and one sediment sample was collected from the drainage ditch northwest of Area A. Samples were analyzed for VOCs, SVOCs, pesticides, and herbicides. A magnetometer and electric conductivity survey were also performed in Area C. The results of the investigation are detailed in the Phase I Site Investigation Report.
- Area B Drainage Ditch Sampling - In May 1993, PCR personnel collected sediment samples at seven locations within the drainage ditch located east of Area B. The samples were field screened using a Dexsil Corporation (Dexsil) total chloride analyzer. Seven samples were submitted to Chester Laboratories for analysis of the organo-chloride pesticides from the Target Compound List, select metals (arsenic, beryllium, and lead), total petroleum hydrocarbons, total organic halogens, and total organic carbon.
- Phase II Site Investigation Report - November 1995 - A Phase II Site Investigation was performed at the Site between October 1994 and May 1995. The goal of the investigation was to further characterize the nature and extent of contamination on and in the immediate vicinity of the Site, in order to support the development of Preliminary Remediation Goals (PRGs) and provide the data necessary to prepare a Response Measures Evaluation Report. Results of the previous USEPA and NJDEP sampling events and the Phase I Site Investigation were used to focus the Phase II sampling activities.
- The purpose of the Phase II investigation was to physically characterize the Site, determine the nature and extent of Site contamination, delineate potential source areas, and identify potential environmental receptors. The overall focus of the

Phase II Site Investigation was on-Site and off-Site soils in the vicinity of specific potential source areas, and a groundwater quality evaluation across the entire Site. The results of the Phase II Site Investigation are presented in detail in the Phase II Site Investigation Report (McLaren/Hart) dated November 10, 1995.

- Off-Site Removal Activities - 1996 - Based on the off-Site sampling results from the Phase II Investigation, a limited removal of impacted surface soils occurred from adjacent properties in the Spring of 1996. Soils removed during these activities were staged on Site for subsequent disposal. A summary of these activities was presented to USEPA in letter reports submitted shortly after completion of the work.

- Results from the Phase I and Phase II Site Investigation Reports comprise the majority of Sitewide data and were used by Camp, Dresser and McKee, as a subcontractor to USEPA, for calculation of the risk-based PRGs for the Site. As such, these important data are summarized in the following sections.

1.4.1 Phase I Investigation Report Data Summary

The Phase I Site Investigation primarily focused on the collection of samples from soil borings, sediments, and groundwater in Area A. A limited investigation was performed in Area B, which included the installation of one boring and the collection of four surface soil samples. The following summarizes the findings of the Phase I Site Investigation.

AREA A

Soil Borings

Soil samples were collected from 19 borings in Area A. Samples for analysis were generally obtained from the 0-2 foot interval (shallow), the 5 to 7 foot interval (intermediate), and the 10 to 12 foot interval (deep). The samples were analyzed for inorganics, volatile organic compounds, semivolatile organic compounds, and pesticides.

Analysis of the soil boring samples revealed that inorganics were detected at concentrations within expected background ranges. The concentrations of lead and arsenic varied between 2.4 and 22.9 ppm and <1.0 and 17 ppm, respectively. Volatile organic compounds were detected in low concentrations at intermittent locations. Soil boring semivolatile data was not summarized in the report. The pesticide results from the soil boring samples are summarized below:

- **Shallow Interval Pesticide Results:** Six shallow soil boring samples were submitted for laboratory analysis. Detected dieldrin and combined DDD, DDE, and DDT concentrations within those samples ranged from 0.25 to 270 ppm and 0.04 to 4.1 ppm, respectively. Aldrin was not detected in any of the shallow boring samples. Borings located near the northeastern perimeter fence and Building 29 contained the greatest concentrations of pesticides.

- **Intermediate Interval Pesticide Results:** Nineteen intermediate soil boring samples were submitted for laboratory analysis. Dieldrin and combined DDD, DDE, and DDT concentrations within those samples ranged from 0.019 to 63.9 ppm and 0.031 to 470 ppm, respectively. Aldrin was detected at concentrations ranging from 0.022 to 6.9 ppm. A boring located within/near the former disposal trench contained the greatest concentrations of these constituents.

- **Deep Interval Pesticide Results:** Nineteen deep soil boring samples were submitted for laboratory analysis. Dieldrin and combined DDD, DDE, and DDT concentrations within those samples ranged from 0.021 to 0.74 ppm and 0.030 to 13.3 ppm, respectively. Aldrin was not detected in any of the deep boring samples. Constituents detected in the subsurface soil boring samples are primarily located within the former disposal trench and near the southwestern perimeter fence.

Sediments

The sediment sample collected from the drainage ditch near the southwest perimeter fence contained 21.1 ppm of DDD. Volatile organic compounds (including benzene, TCE, chlorobenzene, ethylbenzene) were also detected at low concentrations (0.010 to 0.098 ppm). The sediment sample data from the May, 1993 sampling event was not included in this review.

Groundwater

Pesticide concentrations detected in shallow groundwater samples collected during the Phase I Site Investigation include Alpha BHC (0.33 to 84 ppb), Beta BHC (1.2 to 9.0 ppb), Delta BHC (0.2 to 16 ppb), Lindane (0.11 to 4 ppb), DDT (0.1 to 1 ppb), Dieldrin (0.1 to 0.5 ppb), Malathion (0.2 to 23 ppb) and Sevin (152 to 14,500 ppb). Groundwater concentrations appear to be highest at MW-5 which is in the vicinity of the former disposal trench.

AREA B

Soil Borings

Intermediate and deep samples were collected from one soil boring in Area B. Dieldrin and combined DDD, DDE, and DDT concentrations within the two samples were non-detect (ND) and 0.227 to 2.92 ppm, respectively. Aldrin was not detected in the samples.

Surface Soils

Four surface soil samples were collected from Area B in the vicinity of the garage near Boring B-20. Results of the surface soil sampling event indicated that DDT was detected at levels ranging from 2.71 ppm to 27.200 ppm.

1.4.2 Phase II Site Investigation Report Data Summary

The Phase II Site Investigation revealed that the greatest distribution of pesticides was in Area A within the vicinity of the former disposal trench, and along the northeast perimeter fence. The report also indicated that inorganics were present in soils within Area A, but only in some of the areas where elevated levels of pesticide contaminants were detected. Detectable concentrations of semivolatile organic compounds were primarily restricted to one boring location in Area A and one boring location in Area B. Volatile organic compounds were only detected at low concentrations. The following sections provide, in further detail, a summary of the constituents detected in Areas A, B, and C at the Site.

1.4.2.1 Soils

Area A

Surface Soils

Areas of surface soil contamination in Area A are located within the former disposal trench and along the northeastern perimeter fence. Dieldrin and 4.4-DDT were present at these locations in concentrations ranging from 0.750 to 2.200 ppm and 2.5 to 6,800 ppm. respectively. Sampling locations within/near the former disposal trench contained the greatest constituent concentrations.

Arsenic, lead. and chromium concentrations ranged from 2.2 to 132.0 ppm, 17.6 to 480.5 ppm. and 5.3 to 96.5 ppm. respectively. These metals were primarily found within isolated surface soil sampling locations near/within the former disposal trench. and near the southwestern perimeter fence.

Subsurface Soils

Pesticide-containing subsurface soils in Area A are primarily located within the former disposal trench. in areas immediately east of the disposal trench near Building 29. and near the drainage ditch outfall pipe. Concentrations of Dieldrin and DDT range from 0.022 to 63.9 and 0.030 to 442.0 ppm. respectively. Arsenic, lead, and chromium concentrations ranged from 3.1 to 24.8 ppm, 2.4 to 124 ppm, and 4.0 to 47.0 ppm, respectively.

Area B

Surface Soils

DDT was detected in Area B surface soils at concentrations ranging from 0.190 to 280 ppm. Contamination primarily appears to be limited to areas immediately surrounding soil borings SB-54 and SB-19, located approximately 250 feet southeast of New Albany Road. and within the debris area near the eastern corner of the region. The debris area was identified based on the total chlorinated screening results. The CLP DDT data from the debris area indicated lower concentrations than those detected during the screening analyses. Inorganics were detected within background ranges within Area B surface soils.

Elevated levels of semivolatiles in Area B surface soils were detected in one boring installed adjacent to the railroad tracks.

Subsurface Soils

Only low concentrations of pesticides were detected in the subsurface soils within Area B. Combined DDD, DDE. and DDT concentrations in samples below the surface soil "hot spots" located southeast of New Albany Road were less than 2 ppm. Combined DDD. DDE. and DDT concentrations to 65 ppm were detected in the subsurface soils of the debris area located in the eastern corner of the region.

Area C

Surface Soils

CLP data and field screening data from surface samples collected within Area C do not indicate the presence of pesticides at elevated concentrations. DDT was detected at concentrations ranging from 0.022 to 3.8 ppm.

Field screening and CLP data indicate the presence of arsenic at levels ranging from non-detect (ND) to 88 ppm.

Subsurface Soils

The CLP data presented in the Phase II Report indicates that no pesticides, inorganics, volatile or semivolatile compounds are present in subsurface soils of Area C at elevated concentrations.

1.4.2.2 Sediments

Sediment samples were collected from four locations in Area A, four locations in Area B, and one location in Area C. Samples collected in all areas contained 4,4'-DDT in varying concentrations. Concentrations of DDT in Area A were higher than those observed in Areas B and C, ranging from 2.9 ppm to 120 ppm. A more detailed description of the sample locations and analytes of interest are presented below.

Area A

Sediment samples in Area A were collected from the Building 5 Trench (one sample), the storm sewer along New Albany Road (one sample), and the drainage ditch in the western corner of the area (two samples).

The sample collected from the Building 5 Trench (TR-05) contained 4,4' DDT and dieldrin at 40 ppm and 2.1 ppm, respectively. Pentachloronitrobenzene was detected in this sample at 48 ppm. Other semivolatile detections ranged from 0.57 ppm of butyl benzyl phthalate, to 45 ppm of fluoranthene, with concentrations of phenanthrene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and benzo(a)pyrene exceeding 10 ppm. VOCs were detected in low concentrations.

The sample collected from the storm sewer along New Albany Road (STM-01) contained concentrations of dieldrin and 4,4' DDT at 0.1 ppm and 2.9 ppm, respectively. No other analyzed constituents were present at elevated levels.

The drainage ditch sediment samples collected near the initial outfall pipe of the drainage ditch (SED-03) and further downstream (SED-02) contained levels of DDT at 16 ppm and 120 ppm, respectively. Inorganics were not detected at elevated concentrations. Phenol was detected at a concentration of 2.5 ppm.

Area B

Sediment samples in Area B were collected from drainage ditch areas along the railroad tracks on the northeast side of the property (SED-06 and 07) and at the southern border of the property near the debris area (SED-04 and 05). 4.4' DDT concentrations ranged from 0.19 ppm to 6.1 ppm. and dieldrin concentrations ranged from 0.28 to 3.2 ppm. Inorganic concentrations appear to be within background ranges. Volatile organic compounds were not found above detection limits and semivolatiles were detected in very low concentrations.

Area C

One sediment sample was collected from the drainage ditch which runs from Area A through Area C. This sample contained DDT (3.8 ppm) and alpha-BHC (0.310 ppm).

1.4.2.3 Shallow Groundwater

The Phase II Site Investigation Report revealed that the distribution of contaminants in shallow groundwater at the Site is consistent with the distribution of contaminants in soils. The groundwater data described in this section was obtained from analyses of samples collected in February 1995.

Area A

Samples were collected from eight monitoring wells in Area A. Detectable concentrations of alpha BHC. beta BHC, and gamma BHC ranged from 0.013 ppb to 69 ppb. 0.52 ppb to 6 ppb, and 0.42 ppb to 35 ppb, respectively. Detectable concentrations of 4.4'-DDT. DDD. and dieldrin ranged in concentrations from 0.38 to 5.0 ppb and 0.17 to 1.6 ppb, respectively. Inorganics including lead, cadmium, chromium. and arsenic ranged in detectable concentrations from 36.7 to 156 ppb, 7.3 to 49.6 ppb, 249 to 444 ppb, and 100 to 771 ppb, respectively. Volatile organic compounds including tetrachloroethene and benzene ranged in detectable concentrations from 9.0 to 140 ppb and 3 to 15 ppb. respectively. Wells near the former disposal area (MW-05 and -07) contained the highest concentrations of pesticides (alpha-BHC. lindane. dieldrin). Monitoring well MW-5, near the former disposal area, contained the highest concentrations of gamma BHC and dieldrin. The greatest concentrations of alpha-BHC was found in MW-07 (69 ppb). also located near the former disposal area.

Area B

One well (MW-10), located approximately 200 feet Southeast of New Albany Road and 200 feet south of the railroad tracks, contained pesticides alpha-BHC (0.38 ppb). beta-BHC (0.074 ppb), and dieldrin (0.006 ppb). The sample taken from this well also contained arsenic (296 ppb), cadmium (63.3 ppb), lead (69.5 ppb), chloroform (15 ppb), carbon tetrachloride (10 ppb), and tetrachloroethene (25 ppb).

Area C

One well (MW-06), located near the center of Area C, contained detectable levels of alpha-BHC (0.017 ppb), arsenic (72.9 ppb), and lead (53.6 ppb).

1.4.2.4 Deep Groundwater

Deep groundwater was sampled from the Site's former production well. No pesticides, volatile organic compounds, or metals were detected. One semivolatile compound, N-Nitrosodiphenylamine, was detected at an estimated concentration of 0.9 ppb. The production well was abandoned in March 1995 in accordance with applicable regulations.

1.4.2.5 Surface Water

During the Phase II Site Investigation, surface water samples were collected from Area A (two samples), Area B (one sample) and Area C (one sample). Although the surface water samples contained detectable concentrations of Site contaminants, the Phase II Site Investigation Report indicates that sampling procedures caused sediment to be entrained in the surface water samples, potentially affecting the analytical results.

Area A

Two surface water samples were collected in Area A (SW-02 and 03) in the drainage ditch in the western corner of the region. These samples contained detectable concentrations of alpha-BHC (25 and 13 ppb, respectively), beta-BHC (1.8 and 3.2 ppb, respectively), lindane (18 and 6.7 ppb, respectively), dieldrin (ND and 3.5 ppb respectively), 4,4-DDT (ND and 29 ppb, respectively) and its metabolites, as well as detectable concentrations of arsenic, cadmium, chromium, and lead.

Area B

The surface water sample collected in the southern corner of Area B (SW-04) contained alpha BHC (0.49 ppb), beta BHC (0.22 ppb), delta BHC (0.058 ppb), Lindane (0.24 ppb) and dieldrin (0.14 ppb). Inorganics were only detected at very low concentrations (< 10.5 ppb). The surface water sample collected from the swampy area (SW-05) contained levels of DDT (11 ppb) and its metabolites, as well as arsenic (616 ppb), cadmium (65.2 ppb), chromium (518 ppb) and lead (3,220 ppb). Samples collected in the drainage ditch which runs along the railroad tracks (SW-06 and 07) contained alpha BHC (1.5 and 3.8 ppb, respectively), beta-BHC (0.3 and 0.77 ppb, respectively), lindane (ND and 0.53 ppb respectively) and dieldrin (ND and 1 ppb, respectively).

Area C

The surface water sample taken from the drainage area (SW-01) contained detectable levels of alpha-BHC (11 ppb), beta-BHC (1.1 ppb), delta-BHC (4.3 ppb) lindane (7.5 ppb), DDT (4.6 ppb) and dieldrin (0.64 ppb). Cadmium was detected at a concentration of 23 ppb.

1.5 CONTAMINANT FATE AND TRANSPORT

An evaluation of the fate and transport of the chemicals of concern is important in determining the potential for exposure to the constituents. Constituents that are highly mobile in a given medium and are resistant to chemical or biological change are much more likely to result in exposures than constituents with lesser mobility and persistence. The migration of the constituents is influenced by the characteristics of the Site and the surrounding area, and the physical/chemical characteristics of the constituents themselves. This section provides a brief discussion on the mechanics of fate and transport, and summarizes the physical/chemical properties of the Site chemicals of concern in order to determine their environmental fate and transport.

1.5.1 Mechanics of Fate and Transport

"Fate" refers to physical, chemical, or biological processes acting on a constituent to reduce its mass, remove it from the transport medium, or retard its movement through the environment. Fate processes affect the rate of transport and the mass of constituents appearing at a given point within the migration route. The evaluation of constituent fate requires an assessment of the persistence, mobility, and chemistry of the constituent in relation to the Site-specific environmental conditions. "Transport" involves the release and movement of constituents through fluid media such as air, surface water, or groundwater.

A constituent can have many fates in the environment, including the following:

Adsorption. Adsorption is a process whereby a constituent is partitioned onto soils, sediments, or other particulates. Adsorption occurs preferentially to different compounds based on chemical-specific partition coefficients. Adsorption may occur in soils, sediments, and suspended particulate matter in groundwater and surface water. Constituents can be removed from the aqueous phase by adsorption onto solids in contact with water. In addition, suspended solids in surface water may adsorb constituents, thereby influencing their tendencies to volatilize or undergo other reactions. Other factors affecting adsorption of a particular constituent are the surface area of the adsorbent, the presence of charged binding sites, and the presence of organic solvents.

Biodegradation. Biodegradation is the breakdown of a constituent by microorganisms. Biodegradation can occur in soil, sediment, groundwater, and surface water, and is dependent on local environmental conditions and the presence of a microbial population capable of metabolizing the constituents of concern. If biodegradation does occur, soils and surface waters will generally support aerobic degradation, and sediments will usually sustain anaerobic biodegradation. Groundwater may exhibit either aerobic or anaerobic biodegradation, depending on the concentration of dissolved oxygen in the groundwater. Other factors affecting biodegradation include the size, concentration, and availability of the constituent in question, nutrient supply, the temperature and pH of the surrounding media, and the presence of other constituents.

Volatilization. Volatilization is the evaporation of a constituent into the atmosphere. Volatilization may occur at air/water, air/waste, or air/soil interfaces. The extent to which volatilization occurs from soils or solid wastes depends on temperature, degree of saturation of the soil, and relative partitioning of the constituent (Henry's Law constant) between the soil or waste and the atmosphere. Volatilization from surface water depends on water turbulence and temperature and may be inhibited by adsorption of the constituent onto suspended solids.

Hydrolysis. Hydrolysis involves the reaction of a constituent with water. Hydrolysis can occur in any medium (air, soil, or water) with water in the liquid or vapor state. Temperature, stearic effects, and the presence of electron-withdrawing substituents on the constituent affect the rate of hydrolysis.

Photolysis. Photolysis involves the breakdown of a constituent by light energy. It depends on solar radiation reaching the constituents and therefore would be limited to surface soils, shallow depths of surface water, and ambient air. Direct photolysis in the atmosphere can occur for some constituents.

Bioaccumulation. Bioaccumulation of constituents is the collection in living tissues of organic or inorganic constituents to which an organism is exposed. Bioaccumulation is especially important for hydrophobic organic constituents that can be partitioned into fat and lipid tissues. Bioaccumulation also includes inorganic constituents that are partitioned into various tissues. Lead and mercury are examples of inorganic constituents having significant bioaccumulation potential.

1.5.2 Constituent Physical/Chemical Properties

The physical/chemical properties used to qualitatively characterize the fate and transport of constituents in soil include:

- Vapor Pressure
- Henry's Law Constant
- Water Solubility
- Organic Carbon Partitioning Coefficient

These physical/chemical characteristics play a major role in determining a constituent's environmental fate and transport, and govern, to a large extent, the ability of a constituent to move from one matrix to another. A brief discussion of these characteristics is provided below.

Vapor Pressure. Vapor pressure, a relative measure of the volatility of constituents in their pure state, provides an indication of the rate at which a constituent evaporates from both soil and water. Constituents with higher vapor pressures are expected to enter the atmosphere more readily than constituents with lower vapor pressures. Vapor pressure can range from 10^{-3} to 760 mm Hg for liquids to less than 10^{-10} mm Hg for solids.

The Site chemicals of concern have very low vapor pressures at 20-25 degrees centigrade. The constituents are therefore not expected to volatilize into the ambient air.

Henry's Law Constant. The Henry's Law constant, which combines vapor pressure with solubility and molecular weight, is appropriate for estimating releases of constituents from water to air. Compounds with Henry's Law constants of 10^{-3} and greater can be expected to readily volatilize from water. Constituents with values ranging from 10^{-3} to 10^{-5} are associated with significant but not facile volatilization. Constituents with values less than 10^{-5} volatilize from water to a very limited extent (Lyman et al., 1982).

The Henry's Law Constants for the Site chemicals of concern range from 8.30 x 10^{-6} (DDT) to 4.96 x 10^{-4} (aldrin), indicating a very limited to moderate potential to volatilize from moist soil, groundwater, or surface water.

Water Solubility. The water solubility of a substance is critical to determining its environmental fate. Highly soluble constituents can rapidly leach from wastes and soils and are generally mobile in groundwater. Solubilities range from less than 1 mg/liter to totally miscible, with most common organic constituents falling between 1 mg/liter and 1,000,000 mg/liter (Lyman et al., 1982). The solubility of constituents that are not normally soluble in water may be increased in the presence of other more soluble organic solvents.

The water solubilities for the Site chemicals of concern range from 0.005 mg/L (DDT) to 0.195 mg/L (Dieldrin), indicating that the compounds have low solubility in water.

Organic Carbon Partition Coefficient (K_{oc}). The K_{oc} is a first-order approximation of the propensity of a constituent to sorb to the organic matter found in soil. K_{oc} is defined as the ratio of the amount of chemical adsorbed per unit weight of organic carbon in the soil to the concentration of the chemical in solution at equilibrium. The normal range of K_{oc} values is from 1 to 10^7, with higher values indicating greater sorption or binding potential (Lyman et al., 1982). A low K_{oc} indicates a greater potential for leaching from soil into groundwater and transport in an aquifer. A higher K_{oc} suggests a relatively lower potential for leaching.

Generally, K_{oc} is a better determinant of mobility than water solubility because K_{oc} values are normalized for the organic carbon content of soil, and are not strongly dependent upon soil characteristics such as carbon content. The K_{oc} values for the Site chemicals of concern indicate that they are immobile in soil (McLaren/Hart, 1995).

A summary of the physical/chemical properties of the Site chemicals of concern is presented in Table 1-1.

1.6 SUMMARY OF ENDANGERMENT ASSESSMENT

An Endangerment Assessment under CERCLA was performed for the Pulverizing Services Site by Camp, Dresser, McKee Federal Programs Corporation (CDM) on behalf of USEPA Region II. The purpose of the human health assessment was to provide a quantitative analysis of the likelihood of occurrence of adverse effects in the form of non-cancer hazard or theoretical excess lifetime cancer risk. In addition, a qualitative ecological risk assessment was performed.

The human health risk assessment process consists of the following standard steps:

- Identification of Chemicals of Concern
- Exposure Assessment
- Dose-Response (Toxicity) Assessment
- Risk Characterization
- Uncertainty Analysis

Table 1-1[1]
Physical/Chemical Properties of Chemicals of Concern[2]

Constituents	Molecular Weight (g/mol)	Water Solubility (mg/l)	Vapor Pressure (mm HG)	Henry's Law Constant (atm^{-3}/mol)	K_{oc} (ml/g)
4,4'DDT	355	5.0×10^{-3}	5.5×10^{-6}	5.13×10^{-4}	2.43×10^{5}
Dieldrin	381	1.95×10^{-1}	1.78×10^{-7}	4.58×10^{-7}	1.7×10^{3}
Aldrin	365	.18	1.24×10^{-4}	4.96×10^{-4}	4.8×10^{4}

(1) Summarized from the Phase II Site Investigation Report, McLaren/Hart, 1995.
(2) USEPA, 1986; HSDB, 1993; Montgomery and Welkom, 1989.

The first step involves the development of a concentration-toxicity screening process which identified the subset of relevant constituents from the entirety of constituents detected in Site environmental media. The purpose of this step is to eliminate constituents which may be detected, but clearly by nature of low toxicity, and/or infrequent or low level detection are of negligible concern at the Site. Chemicals of concern are retained for further detailed analysis in the quantitative portion of the risk assessment. The chemicals of concern for the risk assessment for this Site are:

- Aldrin, dieldrin, and 4,4'-DDT in soils; and
- alpha-BHC, lindane, dieldrin, arsenic, and cadmium in groundwater.

The next step of the risk assessment, the exposure assessment, involves estimating the potential for exposure at the Site. The USEPA (1989) provides a framework for such analyses. CDM evaluated both residential and industrial uses of the Site as well as exposure to trespassers. The end result of this step is a dose calculation for each potential exposure pathway.

In order to assess the potential for adverse effects, the risk assessment process requires an analysis of the potential toxicity of each constituent. The USEPA provides their consideration of the toxicity of each constituent in their IRIS database. These USEPA toxicity values were used by CDM in the Endangerment Assessment for the Site. CDM then compared the doses to the toxicity estimates for the constituents to arrive at potential non-cancer hazards and theoretical excess lifetime cancer risks. The USEPA target risk range is 10^{-4} to 10^{-6} and the non-cancer hazard benchmark is one. CDM reports a number of constituents whose potential risks exceed the upper end of the risk range and the hazard quotient of one. However, during the toxicity factor screening process, three constituents (aldrin, dieldrin, and 4,4' DDT) were identified as contributing the highest total risk factor to the Site.

Therefore, these three constituents were selected for quantitative evaluation in the Endangerment Assessment.

CDM considered the following exposure scenarios for calculation of Preliminary Remediation Goals (PRGs):

- Carcinogenic and non-carcinogenic residential soil exposure via ingestion;
- Carcinogenic and non-carcinogenic commercial/industrial site worker exposure via ingestion;
- Carcinogenic and non-carcinogenic commercial/industrial construction worker exposure via ingestion; and
- Carcinogenic and non-carcinogenic residential groundwater exposure via dermal contact (showers) and ingestion.

PRGs were calculated for the 10^{-4}, 10^{-5}, and 10^{-6} risk levels for each scenario listed above. These PRGs are presented in Table 1-2.

The qualitative ecological risk assessment included an inventory of the flora and fauna observed at the Site during a one-day visit on May 26, 1995, the use of default assumptions regarding contaminant availability, and a summation of exposure pathways for potential

Table 1-2
Preliminary Risk-Based Remediation Goals (PRGs)
Pulverizing Services Site

Chemical	Carcinogen PRG 10^{-4} (mg/kg)	Carcinogen PRG 10^{-5} (mg/kg)	Carcinogen PRG 10^{-6} (mg/kg)	Non-Carcinogen PRG (mg/kg)
COMMERCIAL/INDUSTRIAL SOIL				
		SITE WORKER		
Aldrin	34	3.4	0.34	61
Dieldrin	36	3.6	0.36	102
4.4'-DDT	1.700	170	17	1.020
		CONSTRUCTION WORKER		
Aldrin	330	33	3.3	24
Dieldrin	350	35	3.5	39.3
4.4'-DDT	16.500	1,650	165	393
RESIDENTIAL SOIL				
Aldrin	3.8	0.38	0.038	8.2
Dieldrin	4.1	0.41	0.041	13.8
4.4'-DDT	190	19	1.9	138

aquatic and terrestrial ecological receptors. The qualitative ecological risk assessment concluded that exposure pathways may exist to ecological receptors; however, the Site-specific characteristics (e.g., the amount of soil that will contain contaminant concentrations at the PRGs after the removal action) in this case reduce ecological risk to an acceptable level.

1.7 LIMITATIONS AND UNCERTAINTIES

Although extensive sampling has been performed at the Site, the following uncertainties and limitations exist and were considered in the evaluation of the response measures:

- Sampling data within the former disposal trench is limited. As a result, a range of volumes of impacted media within the former disposal trench were prepared based on the available analytical data, several assumptions regarding contaminant distribution and depth, and the 10^{-6} risk assessment PRGs.
- Volumes of impacted soil were estimated based on data presented in the Phase I and Phase II Site Investigation Reports and the 10^{-6} risk assessment PRGs. No additional delineation sampling has been conducted at the Site subsequent to the Phase II Investigation.
- Cost estimates for response measures are preliminary and approximate and should be considered comparative estimates.

Section 2

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2.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are designed to be protective of human health and the environment and to meet regulatory requirements. The remedial action objectives for the Pulverizing Services Site were developed using risk-based remediation goals. and applicable or relevant and appropriate requirements (ARARs). Pursuant to Section 121 of CERCLA, and as amended by the Superfund Amendments and Reauthorization Act (SARA), remedial actions at CERCLA Sites must comply with ARARs of Federal and State laws. The remedial action objectives are used to support the development and screening of remedial response measures.

2.1 MEDIA AND CONTAMINANTS TO BE ADDRESSED

Based on the findings of the Endangerment Assessment performed by CDM, chlorinated pesticides (4,4'-DDT, dieldrin, and aldrin) have been identified as the primary chemicals of concern at the Site (see Section 1.6). The purpose of this RME is to identify technologies or combinations of technologies that are capable of mitigating the risks associated with the concentrations of these constituents in Site media (i.e., soils and former disposal trench materials).

Analytical data generated by previous remedial investigations conducted at the Site indicate that soils containing pesticides at varying concentrations are present in several locations within Areas A and B of the Site. Surface soil contamination generally appears to be limited to the first 0-1 feet below grade. Remedial action goals and quantities of material requiring remedial action are discussed in Sections 2.3 and 2.4, respectively.

Previous investigations have indicated that a former disposal trench is located in Area A north of the main production buildings. Media contained within the former disposal trench consists of soil, debris, and other material. Pesticides have been detected at depths up to four to six feet below grade in soils in the area of the former disposal trench. As discussed with USEPA during the scoping of this document, a plan to identify and remove hazardous wastes, if any are identified within the former disposal trench, is being prepared and will be submitted to USEPA for approval subsequent to the finalization of the RME.

In addition to disposal trench media and Site soils, sediment contained in the Building 5 Trench will also require removal. The sediment in the Building 5 Trench will be sampled for RCRA hazardous waste and managed accordingly. A plan to inspect the Building 5 Trench and to sample, manage, and dispose of the media is being prepared and will be submitted to USEPA for approval subsequent to finalization of the RME.

Groundwater has not been addressed by this report because the groundwater will require further evaluation before the need for a remedial action can be evaluated. Although groundwater and sediments are not being formally addressed as part of this RME, it should be noted that the soil remedies under consideration in Sections 3.0 and 4.0 would further reduce the risks to groundwater and sediments through removal or control of potential residual source areas.

2.2 ARARs AND GUIDANCE TO BE CONSIDERED

ARARs and other guidance to be considered (TBCs) are used to: 1) Develop remedial action objectives and determine the appropriate extent of cleanup, 2) Scope and formulate remedial action alternatives, and 3) Govern implementation and operation of the selected remedial action alternative. ARARs and TBCs for the Site are discussed in the following sections.

2.2.1 Definitions of ARARs and TBCs

ARARs are classified as either "applicable". or "relevant and appropriate" requirements. Other guidance and regulations may be classified as TBCs.

Applicable Requirements: Applicable requirements refer to those Federal and State requirements that would be legally enforceable within the context of implementation or operation of the remedial action. An example of an applicable requirement would be the Safe Drinking Water Act's Maximum Contaminant Levels (MCLs) for a Site that causes contamination of a public water supply.

Relevant and Appropriate Requirements: Relevant and appropriate requirements are Federal or State standards, criteria, or guidelines that are not legally enforceable within the context of implementation or operation of the remedial action, but which address problems so similar to those at the Site that their application is appropriate. For example, while RCRA regulations are not applicable to closing undisturbed hazardous waste in place, the RCRA regulations for closure by capping may be deemed relevant and appropriate. During the RME process, relevant and appropriate requirements are intended to have the same weight and consideration as applicable requirements.

To Be Considered: Other Federal and State guidance documents or criteria that are not enforceable but are advisory and "to be considered" during the RME process. For example, where no specific ARARs exist for a chemical or situation, or where such ARARs are not sufficient to be protective, guidance documents or advisories may be considered in determining the necessary level of cleanup for protection of public health and the environment.

2.2.2 Types of ARARs

ARARs and TBCs are further categorized as either chemical-specific, location-specific, or action-specific.

Chemical-Specific: Chemical-specific requirements define acceptable exposure levels for specific hazardous substances and therefore may be used as a basis for establishing preliminary remediation goals and cleanup levels for chemicals of concern in the designated media. Final remediation goals will be determined when the remedy is selected. Chemical-specific ARARs and TBCs are also used to determine treatment and disposal requirements that may occur in a remedial activity.

Location-Specific: Location-specific requirements set restrictions on the types of remedial activities that can be performed based on Site-specific characteristics or location. Location-specific ARARs are triggered when a remedial action impinges on a regulated area. Remedial actions may be restricted or precluded based on Federal and State laws due to the presence of wetlands or floodplains at or in the vicinity of the Site, or due to man-made features such as existing landfills, disposal areas, and local historic landmarks or buildings. Similarly, location-specific ARARs, such as local zoning codes, may be applied in considering remedial actions within the context of appropriate future Site use, as discussed in Section 2.2.3.2.

Action-Specific: Action-specific requirements set controls or restrictions on the design, implementation, and performance of waste management actions. They are triggered by the particular types of treatment or remedial actions that are selected to accomplish the cleanup. After remedial alternatives are developed, action-specific ARARs that specify performance levels, as well as specific levels for discharges or residual chemicals, provide a basis for assessing the feasibility and effectiveness of the remedial alternatives.

2.2.3 Consideration of ARARs

The following section discusses the ARARs and TBCs which may be pertinent to the remedial activities to be performed at the Pulverizing Services Site. Tables 2-1, 2-2, and 2-3, which are presented at the end of Section 2, present summaries of the chemical-, location-, and action-specific ARARs and TBCs which may be pertinent to the Site, respectively. For each ARAR or, the tables: 1) Provide a description of the requirement, standard, or criteria; 2) Provide the status of the ARAR or TBC as it relates to the Site; and 3) Provide comments and the rationale used in determining the status of the ARAR or TBC as it relates to the Site.

2.2.3.1 Chemical-Specific ARARs

Chemical-specific ARARs and TBCs for the Site are identified in Table 2-1. The table includes Federal, State and local requirements and guidance for soils and wastes. Of particular concern are those standards and criteria which can be considered for development of site cleanup goals for soils. Although no ARARs (standards) have been developed by Federal or State agencies, four sets of criteria are TBCs for soil remediation. These TBCs and the degree to which they should be considered are summarized below.

- Final Endangerment Assessment Preliminary Remediation Goals (PRGs) - As part of the Final Endangerment Assessment, Camp, Dresser and McKee identified possible exposure pathways, including inhalation and ingestion; generated exposure scenarios for residential use; site workers, and construction workers, and calculated PRGs based upon 10^{-4}, 10^{-5}, and 10^{-6} human health risk levels. While intended as "site-specific" PRGs, the calculated goals were based on numerous generic and default data, in addition to site-specific sampling data.

The remaining criteria, identified below, have not been promulgated as enforceable standards in New Jersey. These criteria are used as generic guidance, in conjunction with additional site-specific factors, in considering the basis for soils remediation in New Jersey under P.L. 1993, c.139, also referred to as the Industrial Site Recovery Act (ISRA) (NJSA 13:1K-6 et. seq.).

- NJDEP Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) - These criteria are non-site-specific, direct contact human health criteria for commercial and industrial exposure scenarios at sites in New Jersey.
- NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC)- These criteria are non-site-specific, direct contact human health criteria for residential exposure scenarios at sites in New Jersey.
- NJDEP Impact to Groundwater Soil Cleanup Criteria (IGWSCC) - These criteria are used as a comparison point for delineation of subsurface, unsaturated zone source areas of contaminants. IGWSCCs are based on leachability characteristics and are intended to identify sources for remediation so that contaminants are not released which could adversely impact groundwater.
- USEPA Final Soil Screening Guidance, May 17, 1996 - Generic soil screening levels (SSLs) are provided for a number of chemicals based on various pathways of

concern, including ingestion and migration to groundwater. The generic SSLs are derived using default parameters and assumptions for soil, source, and hydrogeologic characteristics.

2.2.3.2 *Location-Specific and Action-Specific ARARs*

Location-specific requirements set restrictions and permitting requirements on the types of remedial activities that may be performed and are triggered when a specific remedial action impinges on the regulated area. Action-specific requirements set restrictions on the design, implementation, and performance of waste management actions and are triggered by the specific actions associated with the selected Site remedy.

Because both of these types of ARARs are dependent upon the selected actions, the status of potential location- and action-specific ARARs cannot be determined until the detailed evaluation of alternatives has been completed. As part of the detailed evaluation, the ability of each alternative to satisfy location- and action-specific ARARs will be evaluated. However, one location specific TBC has been identified and the degree to which it should be considered is summarized below.

- Specially Restricted Industrial (SRI) Districts - Zoning restrictions designed primarily to provide for modern, administrative, research and industrial establishments with a view to encouraging attractive development in areas which are particularly well suited for such uses. The intent of SRI Districts is to encourage only those types of uses which would not constitute a hazard or a nuisance to the residents of adjacent areas and which would contribute to the continuation of appropriate development within and adjacent to the district.

2.3 REMEDIAL ACTION GOALS

Remedial action objectives (RAOs) are intended to clearly state the Site-specific goals to be achieved. Each remedial alternative is evaluated to gauge its ability to satisfy these Site-specific goals. Mitigation of potential health and environmental risks associated with exposure pathways and compliance with State and Federal ARARs comprise the basis of the remedial action objectives. Additionally, consideration is given to the potential impacts of the remediation on designated future land use. Based upon the results of the Site Investigations, the Endangerment Assessment, and the overall Site physical characteristics, as well as a review of potential ARARs, the following remedial action objectives have been identified for the Site:

1. Remedial actions shall mitigate potential routes of human health and environmental exposure to contaminated soils.

2. Remedial actions shall comply with ARARs to the extent practical.

3. Remedial alternative selection shall consider future land use.

On-going discussions with USEPA have indicated that a number of remedial action objectives may be applicable to the Site. These include several site-specific risk-based 10^{-5} and 10^{-6} PRGs, the NJDEP RDCSCC, NRDCSCC, IGWSCC, and EPA's Region III Risk-Based Criteria for industrial and residential land use. The NJDEP and EPA criteria are not promulgated enforceable standards, but rather generic criteria that can be considered in conjunction with a range of site-specific factors for soils remediation work.

Table 2-4, presented at the end of this section, identifies the potentially applicable cleanup criteria for pesticides and other contaminants detected in soils at the Site. Table 2-5, presented at the end of the section, identifies the RAOs that have been selected for the Site and associated compounds detected in areas where the selected PPG's were exceeded.

2.4 VOLUMES OF IMPACTED MEDIA

For Site soils and former disposal trench media, volumes of impacted media were estimated based on data presented in the Phase I and Phase II Site Investigation Reports, using the Risk Assessment 10^{-6} PRGs for Commercial Site Worker and Construction Worker scenarios. These volumes are summarized in Table 2-6.

TABLE 2-1
PULVERIZING SERVICES SITE
POTENTIAL CHEMICAL - SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	**Citation**	**Description**	**Status**	**Comment**
FEDERAL ARARs				
MULTI-MEDIA				
Resource Conservation and Recovery Act (RCRA) - Identification and Listing of Hazardous Waste	40 CFR 261	Defines those solid wastes which are subject to regulations as hazardous wastes under 40 CFR Parts 262-265 and 270.	Relevant/Appropriate	Relevant to wastes or treatment residues which are hazardous as defined by RCRA and are to be disposed of off site.
Preliminary Remediation Goals (RPGs)	Final Endangerment Assessment, CDM-FPG, February 2, 1996	Calculates site-specific, risk-based preliminary remediation goals for aldrin, dieldrin, and DDT.	To Be Considered	The PRGs are to be considered for remediation of Site soils and former disposal trench media
USEPA Soil Screening Guidance	Soil Screening Guidance Technical Background Document, USEPA, OSWER, EPA/540/R-95/128, May 1996.	Generic soil screening levels based on various pathways of concern, including ingestion and migration to groundwater.	To Be Considered	May be considered for remediation of site soils and former disposal trench media.
WATER				
Safe Drinking Water Act (SDWA) National Primary Drinking Water Standards	40 CFR 141	Establishes health-based standards for public drinking water systems.	Relevant/Appropriate	Since the Site is located within the boundaries of the NJ Coastal Plan Sole Source Aquifer and the Maximum Contaminant Levels (MCLs) for inorganic and organic contaminants are legally enforceable for public drinking water supplies, groundwater within this region is classified as a Class IIA Current Source of Drinking Water. These standards may be considered relevant and appropriate.
SDWA National Secondary Drinking Water Standards	40 CFR 143	Establishes drinking water quality goals set at levels of anticipated adverse health effects, with an adequate margin of safety.	To Be Considered	MCLGs for inorganic and organic contaminants are established using health-based criteria. MCLGs may be considered in determining the need for CEA

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TABLE 2-1
PULVERIZING SERVICES SITE
POTENTIAL CHEMICAL - SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
SDWA Maximum Contaminant Level Goals (MCLGs)	40 CFR 141.11 - 141.16	Establishes drinking water quality goals set at levels of anticipated adverse health effects, with an adequate margin of safety.	To Be Considered	MCLGs for inorganic and organic contaminants.
Clean Water Act (CWA) Ambient Water Quality	40 CFR 131	Sets criteria for surface water quality based on toxicity to aquatic organisms in human health.	To Be Considered	Criteria available for water consumption and fish ingestion only for human health. Criteria available for freshwater and marine water for aquatic life. May be a TBC for surface water and/or discharge of soil treatment waters to surface water.
Toxic Pollutant Effluent Standards	40 CFR 129	Establishes effluent standards or prohibitions for certain toxic pollutants including aldrin, dieldrin, and DDT.	Not Applicable	The alternatives do not include discharge to surface water.
AIR				
National Ambient Air Quality Standards (NAAQS)	40 CFR 50	Defines levels of air quality adequate to protect the public heath and welfare. Defines emissions limitations for sulfur oxides, particulate matter, and carbon monoxide.	Applicable	May be applicable to remedial alternatives resulting in air emissions.
STATE ARARs				
SOLIDS				
Sludge Quality Criteria	NJAC 7:14-4 Appendix B-1	New Jersey Water Pollution Control Act Contaminant Indicators.	Relevant/Appropriate	May be relevant and appropriate for sludges generated during soil treatment.
New Jersey Department of Environmental Protection (NJDEP) Residential Direct Contact Soil Cleanup Criteria	NJAC 7-26D	Direct contact cleanup criteria for soils at residential sites.	To Be Considered	NJDEP requires delineation of contamination to residential levels.

TABLE 2-1
PULVERIZING SERVICES SITE
POTENTIAL CHEMICAL - SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
NJDEP Non-Residential Direct Contact Soil Cleanup Criteria	NJAC 7-26D	Direct contact cleanup criteria for soils at industrial or commercial sites	To Be Considered	Criteria may be considered in setting cleanup goals for contaminated soils at the Site.
NJDEP Impact to Groundwater Soil Cleanup Criteria	NJAC 7-26D	Soil cleanup criteria for protection of groundwater	To Be Considered	Criteria may be considered in setting cleanup goals for contaminated soils at the Site
GROUNDWATER				
NJDEP Groundwater Quality Standards	NJAC 7:9-6 NJAC 7:14A-6.15	New Jersey Water Pollution Control Act standards for groundwater.	Relevant/Appropriate	May be relevant and appropriate for determining the need for CEA based on existing groundwater monitoring data
Safe Drinking water Act (SDWA) Maximum Contaminant Levels (MCLs)	A-280 Amendments	Establishes State criteria for drinking water.	Relevant/Appropriate	State MCLs may be relevant and appropriate for groundwater if more stringent than Federal MCLs.
SURFACE WATER				
New Jersey Pollutant Discharge Elimination System (NJPDES)	NJAC 7:14a	Establishes discharge standards when written into permits.	Applicable	May be applicable for discharge of run-on to surface water
Surface Water Criteria	NJAC 7:9-4	Criteria for surface water classes.	Relevant/Appropriate	May be relevant and appropriate for discharge of run-on to surface water
AIR				
Prohibition of Air Pollution and Ambient Air Quality Standards	NJAC 7:27-5 NJAC 7:27-13	Prohibits air pollution and establishes ambient air quality standards.	Applicable	Applicable for alternatives which include technologies that result in air emissions.

TABLE 2-2
PULVERIZING SERVICES SITE
POTENTIAL LOCATION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
FEDERAL ARARs				
Executive Order Floodplain Management	Exec. Order No 11988 40 CFR 2 6:302(b) and Appendix A	Requires federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the maximum extent possible, the adverse impacts associated with direct and indirect development of a floodplain	Not Applicable	The facility is not located in or near a 100-year or 500-year floodplain.
Federal Flood Plains Regulatory Requirements	(RCRA Location Standards (40 CFR 264 18)	This regulation outlines the requirements for constructing a RCRA facility on a 100-year flood plain.	Not Applicable	The facility is not located in or near a 100-year floodplain
National Wildlife System	16 U.S.C 668 50 CFR 27	Restricts activities within a National Wildlife Refuge.	Not Applicable	Site is not on or adjacent to a wildlife refuge.
Wild and Scenic Rivers Act	16 U.S.C. 1274 40 CFR 6:302 (e)	Prohibits adverse effects on scenic rivers.	Not Applicable	No rivers border this Site.
Clean Water Act	33 U.S.C 1251 Section 404, 40 CRF 230, 231	Prohibits discharge of dredged or fill material into wetlands without a permit Preserves and enhances wetlands	Applicable	May be applicable for alternatives which involve disturbance to wetlands.
Endangered Species Act	16 U S C 1531	Restricts activities where endangered species may be present.	Not Applicable	No endangered species have been observed at the Site during ecological site assessments.

TABLE 2-2
PULVERIZING SERVICES SITE
POTENTIAL LOCATION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
National Historic Preservation Act	16 U S C 470	Requires federal agencies to take into account the effect of any federally-assisted undertaking or licensing on any district, site, building, structure, or object that is included in or is eligible for inclusion in the National Register of Historic Places.	Not Applicable	The facility is not included or eligible for inclusion in the National Register of Historic Places
U S Army Corps o f Engineers Nationwide Permit Program	33 CFR 330	Prohibits activity that adversely affects a wetland if a practical alternative that has less effect is available	Applicable	May be applicable for alternatives which have the potential to affect wetlands
Historic Sites, Buildings and Antiquities Act	16 U S C ss 461-467	Requires federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	Not Applicable	The Site is not included on the National Registry of Natural Landmarks
Rivers and Harbors Act of 1899	33 CFR 320-330	Establishes a COE permit program for dams, dikes, dredging, and other construction in navigable waters of the U S	Not Applicable	No construction in navigable waters is included in remedial alternatives
Executive Order Protecting Wetlands	Executive Order No 11990	Requires Federal agencies to minimize the destruction, loss, or degradation of all wetlands affected by Federal activities	Relevant/Appropriate	May be relevant for alternatives which have the potential to affect wetlands.

TABLE 2-2
PULVERIZING SERVICES SITE
POTENTIAL LOCATION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
Fish and Wildlife Coordination Act	16 U S C 661 40 CFR 2 6:302 (g)	Requires consultation with the U.S. Fish and Wildlife Services when a Federal department or agency proposes or authorizes any modification of any stream or other water body, and adequate provision for protection of fish and wildlife resources	Relevant/Appropriate	Any disturbance and restoration or replacement of wetlands must be coordinated with the Fish and Wildlife Service
National Ambient Air Quality Standards (NAAQS)	40 CFR 50	Establishes non-attainment zones with respect to health-based criteria	Applicable	Applicable to remedial activities which emit restricted contaminants into the atmosphere.
STATE ARARS				
Flood Hazard Area Regulations	NJAC 7:13	Protects floodplains through permitting requirements for construction and development activities.	Not Applicable	Facility is not located in or near a 100- or 500-year floodplain.
Flood Hazard Area Control Act	NJSA 58 16A-50	Delineates flood hazard areas and regulates use.	Not Applicable	Facility is not located in or near a 100- or 500-year floodplain.
Wetland Act of 1970	NJSA 13 9A-1 et seq.	Establishes listing and permitting requirements for regulated activities	Applicable	May be applicable for alternatives which include disturbance of wetlands.
Freshwater Wetlands Protection Act	NJSA 13 9B	Establishes listings and permitting requirements for regulated activities in state freshwater wetlands	Applicable	May be applicable for alternatives which include disturbance of wetlands.

400041

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TABLE 2-2
PULVERIZING SERVICES SITE
POTENTIAL LOCATION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
Open Lands Management	NJAC 7:2-12.1 et.seq.	Considers impact of remedial actions on recreational projects funded by Open Lands Management Grants.	Not Applicable	There are no recreational projects nearby that were funded by an Open Lands Management Grant.
New Jersey Threatened Plant Species	New Jersey's Threatened Plan Species	Lists threatened plant species.	To Be Considered	Informal consultation with U.S. Fish and Wildlife Service is recommended by NJDEP.
Natural Areas System	NJAC 7:2-11	Protects natural area sites listed under the Natural Areas Register	Not Applicable	Not sites listed on the Natural Areas Register will be affected by the remedial action.
State Trails System	NJSA 13:8-30 et. seq.	Requires that use of trail does not interfere with nature; maintains natural and scenic qualities.	Not Applicable	No state trails are located within the anticipated remediation areas.
New Jersey Wild and Scenic Rivers System	NJSA 13:8-45 et. seq.	Governs component river area, flood hazard area, or part of state park, wildlife refuge or similar area.	Not Applicable	No such areas are located at the Site.
Endangered Plant/Animal Species Habitats	New Jersey's Endangered Species Act	Lists threatened habitats where endangered species occur	To Be Considered	Informal consultation with the U.S. Fish and Wildlife Service is recommended by NJDEP.
LOCAL ARARS				
Specially Restricted Industrial (SRI) Districts	Township of Morristown Local Zoning Ordinance	Zoning restrictions designed primarily to provide for modern, administrative, research and industrial establishments with a view to encouraging attractive development in areas which are particularly well suited for such uses.	Potentially Applicable	Site location within an SRI district

TABLE 2-3
PULVERIZING SERVICES SITE
POTENTIAL ACTION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	**Citation**	**Description**	**Status**	**Comment**
FEDERAL ARARs				
RCRA Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on heath or the environment and thereby constitute prohibited open dumps.	Relevant/Appropriate	The current Subtitle D program is principally aimed at municipal and industrial solid waste. Relevant and appropriate to alternatives which include disposal of non-hazardous waste on site.
RCRA Hazardous Waste Identification Rule (HWIR) for Contaminated Media	40 CFR 260, 261, 266, 268	Revisions to RCRA which provide constituent-specific "bright-line" concentrations below which contaminated media may be deemed non-hazardous and thereby be removed from regulation under RCRA. Also provides for modification of the Land Disposal Restrictions (LDRs) for hazardous media such as soils.	To Be Considered	These proposed regulations are to be considered for alternatives which include disposal options currently regulated under RCRA.
RCRA Hazardous Waste Management Systems General	40 CFR 260	Establishes procedures and criteria for modification or revocation of any provision in 40 CFR Part 260-265	Relevant/Appropriate	Establishes general requirements for hazardous waste management.
RCRA Standards Applicable to Generators of Hazardous Waste	40 CFR 262	Establishes standards for generators of hazardous waste.	Applicable	Waste disposed of off site and residuals generated by some treatment alternatives may be classified as RCRA hazardous waste

TABLE 2-3
PULVERIZING SERVICES SITE
POTENTIAL ACTION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
RCRA Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Establishes standards which apply to persons transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR 262	Applicable	Applicable for alternatives involving off-site transportation of hazardous treatment residuals or other hazardous waste.
RCRA Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR 264	Establishes minimum national standards which defines the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste.	Relevant/Appropriate	These regulations are relevant and appropriate for any action that involves treatment or disposal in a RCRA facility.
RCRA Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR 265	Establishes minimum national standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure, or if the facility is subject to post-closure, until responsibilities are fulfilled.	Not Applicable	Remedies should be consistent with the stricter requirements of Part 264 for CERCLA actions.
RCRA Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	40 CFR 266	Establishes requirements which apply to recyclable materials that are reclaimed to recover economically significant amounts of precious metals, including gold and silver.	Not Applicable	Precious metals recycling is not considered part of any remedial alternative for the Site.

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TABLE 2-3
PULVERIZING SERVICES SITE
POTENTIAL ACTION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	**Citation**	**Description**	**Status**	**Comment**
RCRA Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities	40 CFR 267	Establishes minimum national standards that define acceptable management of hazardous waste for new land disposal facilities.	Not Applicable	CERCLA actions should be consistent with stricter requirements of Part 264.
RCRA Land Disposal Restrictions	40 CRF 268.43	Establishes a timetable for restriction of burial of hazardous wastes.	Applicable	Regulates land disposal of any hazardous waste that may be generated on site, or off site during treatment
Toxic Substances Control Act	40 CFR 761	Establishes health data, chemical advisories, and compliance program policy	Not Applicable	TSCA regulates manufacture and use, but not disposal, of pesticides
CLEAN WATER ACT				
Water Pollution Control Act	33 U.S.C. 1251	Protects and maintains the chemical, physical and biological integrity of the nation's water.	Applicable	Applicable for actions which may affect water quality.
Effluent Limitations	33 U.S.C. 1251 Section 301	Technology-based discharge limitations for point sources of conventional, nonconventional and toxic pollutants.	Applicable	Applicable for actions which include discharge of wastewater.
Water Quality Related Effluent Limitations	33 U.S.C. 1251 Section 302	Protection of intended uses of receiving waters (e.g., public water supply, recreations uses)	Applicable	Applicable for actions which include discharge of wastewater.
Toxic and Pretreatment Effluent Standards	33 U.S.C. 1251 Section 307	Establishes list of toxic pollutants and promulgates pretreatment standards for discharge into POTWs.	Applicable	Applicable for actions which include discharge of wastewater

TABLE 2-3
PULVERIZING SERVICES SITE
POTENTIAL ACTION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
National Pollutant Discharge Elimination System (NPDES)	33 U S C 1251	Issues permits for discharge into navigable waters	Applicable	May be applicable for actions involving discharge to surface water.
Disposal of Dredged and Fill Material	33 U S C 1251 Section 404	Requires permitting of discharges of dredged and fill material to navigable waters	Not Applicable	Alternatives under consideration will not require discharge of dredged and fill material to navigable waters
SAFE DRINKING WATER ACT				
Underground Injection	40 CRF 144-147	Provides requirements for an Underground Injection Control (UIC) plan and establishes classification of wells.	Not Applicable	Underground injection of wastes or wastewaters is not included in any remedial alternative for the Site
OTHER				
Occupational Safety and Health Act	29 U S C ss 651-678; 29 CFR 1910, 1926, 1904	Regulates worker health and safety Specifies the training requirements for workers at hazardous waste operations, and the type of safety equipment and procedures to be followed during site remediation	Applicable	Under 40 CFR 300 38, requirements this Act apply to all response activities under the NCP
Hazardous Materials Transportation Act	49 CFR Parts 100-177	Regulates transportation of hazardous materials	Applicable	Maybe applicable if alternative selected involves transportation of hazardous materials
CLEAN AIR ACT				
National Ambient Air Quality	40 CFR 50, 40 CFR 60 NSPS Subpart E	Establishes emission limits for seven pollutants Describes test methods and procedures to determine particulate emissions	Applicable	Applicable if remedial alternative includes a technology that would result in air emissions

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TABLE 2-3
PULVERIZING SERVICES SITE
POTENTIAL ACTION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	**Citation**	**Description**	**Status**	**Comment**
Listing Criteria	42 U S C 7401 Section 112	Establishes health basis to list pollutants as hazardous	Applicable	Applicable if remedial action includes a technology that would result in air emissions
STATE ARARS				
AIR POLLUTION CONTROLS				
Prohibition of Air Pollution and Ambient Air Quality Standards	NJAC 7:27-5 and 13	Establishes ambient air quality standards	Applicable	Ambient air quality standards are applicable if remedial action includes a technology that would result in air emissions
Permitting Requirements	NJAC 7:27-8	Establishes permit conditions for air pollution control apparatus	Applicable	Requirements must be met if remedial action includes a technology that would result in air emissions
Air Pollution control	NJAC 7:27-11 and 17	Controls and prohibits air pollution, particle emissions, and toxic VOC emissions	Applicable	Applicable if remedial action includes a technology that would result in air emissions
Operating Standards for Hazardous Waste Incinerators	NJAC 7:26-10	Specifies maximum air contaminant emissions rates, testing requirements, and minimum design standards	Not Applicable	On-site incineration is not under consideration for this Site
Interim Standards for Hazardous Waste Incinerators	NJAC 7 26-11	Specifies maximum air containment emission rates, testing requirement, and minimum design standards during interim status	Not Applicable	On-site incineration is not under consideration for this Site
Incinerator Permit Regulations	NJAC 7:26-12	Delineates the information needs to be submitted in Part A and B of the permit application	Not Applicable	On-site incineration is not under consideration for this Site

TABLE 2-3
PULVERIZING SERVICES SITE
POTENTIAL ACTION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
GROUNDWATER CONTROLS				
NJDEP Groundwater Quality Standards	NJAC 7:9-6 NJAC 7: 4A-6.14	Protection and enhancement of groundwater resources	Applicable	May be applicable in determining the need for a CEA based on monitoring data.
Requirement for Groundwater Monitoring	NJAC 7:26-9	Groundwater monitoring system requirements.	Applicable	Applicable for any remedial alternative requiring groundwater monitoring
DISHCARGES TO SURFACE W^TER				
New Jersev Pollutant Discharge Elimination System (NJPDES)	NJAC 7:14A	Issue NJPDES permits for discharge to surface water and groundwater.	Applicable	Applicable if water from soil treatment is discharged to surface water
Water Quality Standards	NJAC 7:9-4.1 et seq.	Protects and enhances surface water resources.	Applicable	Applicable if soil treatment generates wastewaters that are discharged to surface water.
Wastewater Discharge Requirements	NJAC 7:9-5.1	Minimum treatment requirements and effluent standards for discharge to surface water	Applicable	Applicable if waters generated by treatment technology are discharged to surface water.
Industrial Site Recovery Act	P.L. 1993c.139 NJSA 13:1K-6 et seq.	Regulates investigation and remediation of industrial sites in New Jersey.	Applicable	Applicable in developing response measures and cleanup levels.
Worker and Community Right to Know Act	P.L. 1983c.315 P.L. 1985c.543 Executive Order #161	Submission of hazardous substances to State Emergency Planning Commissions and to local Emergency Planning Committees.	Applicable	Applies to all on-site treatment alternatives.
Underground Storage Tanks (USTs)	NJAC 7:14B	Monitors performance and maintenance of USTs.	Not Applicable	USTs are not part of the planned remedial alternative of the Site.

TABLE 2-3
PULVERIZING SERVICES SITE
POTENTIAL ACTION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
Safe Drinking Water	NJSA 58:12A	Regulates periodic testing o f Public Community Water Systems.	Relevant/Appropriate	Periodic groundwater monitoring may be part of the remediation alternatives.
Interim Safe Drinking Water Testing Schedule	NJAC 7:10-14.1 et seq.	Requires periodic testing, analysis and reporting for Public Community Water Systems.	Relevant/Appropriate	Periodic groundwater monitoring may be part of the remediation alternatives.
New Jersey Safe Drinking Water Act	NJAC 7:10	Sets standards for drinking water including MCLs, disinfecting requirements, secondary drinking water regulations, and monitoring requirements.	Relevant/Appropriate	May be relevant and appropriate if more stringent than the Federal MCLs
OTHER				
Emergency Response Notice of Release of Hazardous Substance to Atmosphere	NJSA 7:26, 26:2C-19	Control exposure to air pollution by immediate notification to the department hotline of any air release incident.	Applicable	May be applicable for any technology having the potential to result in an air release
Water Pollution Control	NJAC 7:21(E)	Immediate notification of any spill of hazardous substances	Applicable	May be applicable for any technology having potential for a spill of a hazardous substance.
Noise Control Act	NJSA 13:1G-1 et seq.	Prohibits and restricts noise which unnecessarily degrades the quality of life.	Applicable	May be applicable for any remedial action
Noise Pollution	NJAC 7:29-1	Sets maximum limits of sound from any industrial, commercial, public service or community service facility.	Applicable	May be applicable for any remedial actions.

TABLE 2-3
PULVERIZING SERVICES SITE
POTENTIAL ACTION- SPECIFIC ARARS

Standard, Requirement, Criteria or Limitation	Citation	Description	Status	Comment
WELL DRILLING AND SEALING				
General Requirements for Permitting Wells	NJAC 7:9-7	Regulates permit procedures, general requirements for drilling and installation of wells, licensing of well driller and pump installer, construction specification, and well casing.	Applicable	Applicable if additional wells are required, or if existing wells should require modification.
Sealing of Abandoned Wells	NJAC 7:9-9	General requirements for sealing of all wells (e.g., single cased, multiple cased, hand dug, test wells, boreholes and monitoring wells, abandoned wells).	Applicable	Applicable if any existing wells need to be abandoned and sealed.
Well Drillers and Pump Installers Act	NJSA 58:4A-5 et seq.	Well drillers licensing, supervision, inspection and sampling.	Applicable	Applicable if additional wells are required for groundwater monitoring.
	NJS, 6 NYCRR 182	Endangered and threatened species of fish and wildlife requirements	Action	May relate to remediation of all areas

Table 2-4
Pulverizing Services Site
Soil-Based Chemical-Specific ARARs and TBCs

Contaminants	Residential RA PRG 10^{-5}	Commercial Site Worker RA PRG 10^{-5}	Commercial Construction Worker RA PRG 10^{-5}	Residential RA PRG 10^{-6}	Commercial Site Worker RA PRG 10^{-6}	Commercial Construction Worker RA PRG 10^{-6}	NJDEP Residential Direct Contact Soil Cleanup Criteria	NJ Non-Residential Direct Contact Soil Clean-up Criteria	NJDEP Impact to Ground Water Soil Cleanup Criteria	USEPA Generic Soil Screening Levels for Ingestion	USEPA Generic Soil Screening Levels for Migration to Groundwater**	Frequency of Detects/ Number of Samples	Range of Detected Sample Concentrations (ppm)	Sample with High Concentration
4,4'-DDE	NA	NA	NA	NA	NA	NA	2	9	50	2	54	32/81	0.018 - 226	SS-4A/0.75-1
4,4'-DDD	NA	NA	NA	NA	NA	NA	3	12	50	3	16	36/81	0.0016 JN -1,940	SS-38-0.75-1.0
4,4'-DDT	19	170	1650	1.9	17	165	2	9	500	2	32	36/81	0.0067 JN - 27,200	SS-38-0.75-1.0
Acetone	NA	NA	NA	NA	NA	NA	1000	1000	100	7,800	16	8/18	0.011 - 0.995	B19/S3A 4-7
Aldrin	0.38	3.4	33	0.038	0.34	3.3	0.040	0.17	50	0.04	0.5	3/67	0.022 - 69.0	SB-07-0-0.5
Alpha-BHC	NA	NA	NA	NA	NA	NA	NE	NE	NE	0.1	0.0005	18/53	0.009-14.7	B6/S3A/5-8
Aluminum	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	22/39	2,240 - 12,300	SB-09-0-0.5
Arsenic	NA	NA	NA	NA	NA	NA	20	20	h	0.4	29	39/45	12 - 132	SB-07-0-0.5
Barium	NA	NA	NA	NA	NA	NA	700	47000 n	h	5,500	1,600	18/37	30 - 79	SB-13-0-0.5
Benzo (a) anthracene	NA	NA	NA	NA	NA	NA	0.9	4	500	0.9	2	1/45	0.400 - 2.05	SB-66/0.5-AV
Benzo (a) pyrene	NA	NA	NA	NA	NA	NA	0.66	0.66	100	0.09	8	1/45	1.30 - 1.30	SB-66/0.5-AV
Benzo(b) fluoranthene	NA	NA	NA	NA	NA	NA	0.9	4	50	0.9	5	2/45	0.480 - 4.15	SB-66/0.5-AV
Benzo (g,h,i)perylene	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	1/45	0.548 - 0.548	SB-66/0.5-AV
Benzo(k) fluoranthene	NA	NA	NA	NA	NA	NA	0.9	4	500	9	49	1/45	1.70 - 1.70	SB-66/0.5 - AV
Beryllium										0.1	63		0.34 - 1.80	SB-10/0-0.5
Beta-BHC	NA	NA	NA	NA	NA	NA	NE	NE	NE	0.4	0.003	3/14	0.003 - 2.30	B6/53A-5-8
bis (2-Ethylhexyl) Phthalate	NA	NA	NA	NA	NA	NA	49	210	100	46	3,600	1/45	0.670 - 1.40	SB-60-1-2
Butylbenzyl-phthalate	NA	NA	NA	NA	NA	NA	1100	10000 c	100	16,000	930	1/45	0.74 - 1.00	SB-60 - 1-2
Cadmium	NA	NA	NA	NA	NA	NA	1	100	h	78	8	4/22	0.25 - 11.4	TP-06B-5-6
Calcium	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	22/39	20.0 - 9600	SB-09-0-0.5
Carbaryl										NE	NE		0.041 - 3900	TP-06B-6-7
Chromium	NA	NA	NA	NA	NA	NA	NE	NE	NE	390	38	47/47	1.5B - 137.9	TR-078-4-5
Chrysene	NA	NA	NA	NA	NA	NA	9	40	500	88	160	1/45	3.00 - 30.00	SB-66/0.5-AV
Cobalt	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	10/37	2.00 B - 7.00	B2A/S15-6.5
Copper	NA	NA	NA	NA	NA	NA	600 m	600 m	h	NE	NE	7/8	3.00 - 30.00	B7/53A 5-7

400051

Table 2-4
PPG Pulverizing Services Site
Soil Based Chemical Specific ARARs and TBCs

Contaminants	Residential RA PRG 10^{-5}	Commercial Site Worker RA PRG 10^{-5}	Commercial Construction Worker RA PRG 10^{-5}	Residential RA PRG 10^{-6}	Commercial Site Worker RA PRG 10^{-6}	Commercial Construction Worker RA PRG 10^{-6}	NJDEP Residential Direct Contact Soil Cleanup Criteria	NJ Non-Residential Direct Contact Soil Clean-up Criteria	NJDEP Impact to Ground Water Soil Cleanup Criteria	USEPA Generic Soil Screening Levels for Ingestion	USEPA Generic Soil Screening Levels for Migration to Groundwater**	Frequency of Detects Number of Samples	Range of Detected Sample Concentrations (ppm)	Sample with High Concentration
Delta-BHC	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	8/46	0.003 - 0.290 J	SB-09/1-2
Di-n-butyl-phthalate	NA	NA	NA	NA	NA	NA	5700	10000	100	7,800	2 300	5/45	0.470 - 4.20	SB-10/1-2
Dieldrin	0.41	3.6	35	0.041	0.36	3.5	0.042	0.18	50	0.04	0.004	14/67	0.019 - 2200	SB-07-0-0.5
Endosulfan I	NA	NA	NA	NA	NA	NA	340 g	6200 g	50	470	18	5/60	0.017 - 0.670 J	SB-19/0-0.5
Endrin	NA	NA	NA	NA	NA	NA	17	310	50	23	1	1/67	0.355 - 0.355	SB-40/0.5-AV
Endrin ketone										NE	NE		0.010 - 80.0	SB-07/0-0.5
Fluoranthene	NA	NA	NA	NA	NA	NA	2300	10000	100	3,100	4,300	1/45	0.710 - 3.70	SB-66/0.5 - AV
Heptachlor epoxide										0.07	0.7		0.100-0.100	SB-96A/0-0.5
Hexachloro-benzene	NA	NA	NA	NA	NA	NA	0.66 f	2	100 i	0.4	2	2/45	0.570 - 200	SB-07/0-0.5
Indeno (1,2,3-cd) pyrene	NA	NA	NA	NA	NA	NA	0.9	4	500	0.9	14	1/45	1.10 - 1.10	SB-66/0.5-AV
Iron	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	22/39	3450 - 62,200	SB-10-0-0.5
Lead	NA	NA	NA	NA	NA	NA	400 p	600 q	h	400	NE	46/47	1.1 J - 480 J	SB-36/0.5 - AV
Lindane	NA	NA	NA	NA	NA	NA	0.52	2.2	50	0.5	0.009	13/67	0.062 - 33.0	SB-07-0-0.5
Malathion	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	6/74	0.019 - 0.260	SB-10-0-0.5
Manganese	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	19/39	60 - 331	SB-09-0-0.5
Mercury	NA	NA	NA	NA	NA	NA	14	270	h	NE	NE	10/39	0.08 - 1.10	SB-19-0-0.5
Methoxychlor	NA	NA	NA	NA	NA	NA	280	5200	50	390	160	1/67	4.90 X - 15.0	SB-96/0-0.5
Methylene chloride										85	0.02		0.009 - 0.110	B6/S3A 5-8
Nickel	NA	NA	NA	NA	NA	NA	250	2400 k n	h	1,600	130	16/39	5.00 B-11.00	B11/S3A 4-7
Octachlorod benzo-p-dioxin	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	10/10	0.0005 - 0.0054	TB08A-1-2
Phenol	NA	NA	NA	NA	NA	NA	10000 c	10000 c	50	47,000	100	5/45	0.410 - 39.0	SB-36/0-0.5
Potassium	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	22/39	130 - 1,420	B11/S3A 4-7
Pyrene	NA	NA	NA	NA	NA	NA	1700	10000	100	2,300	4,200	1/45	0.660 - 3.00	SB-66/0.5 - AV
Rotenone										NE	NE		2.30 - 2.30	TP-06B 5-6
Selenium	NA	NA	NA	NA	NA	NA	63	3100	h	390	5	7/37	0.72 B- 15.20	SB-13-0-0.5
Sevin	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	26/74	0.041 - 3100	TP-089-1-2
Sodium	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	15/37	80 - 375 B	SB-09-0-0.5
Thallium	NA	NA	NA	NA	NA	NA	2 f	2 f	h	NA	0.7	3/18	0.95 B - 2.30	SB-10-0-0.5

Table 2-4
PPG Pulverizing Services Site
Soil Based Chemical Specific ARARs and TBCs

Contaminants	Residential RA PRG 10^{-5}	Commercial Site Worker RA PRG 10^{-5}	Commercial Construction Worker RA PRG 10^{-5}	Residential RA PRG 10^{-6}	Commercial Site Worker RA PRG 10^{-6}	Commercial Construction Worker RA PRG 10^{-6}	NJDEP Residential Direct Contact Soil Cleanup Criteria	NJ Non-Residential Direct Contact Soil Clean-up Criteria	NJDEP Impact to Ground Water Soil Cleanup Criteria	USEPA Generic Soil Screening Levels for Ingestion	USEPA Generic Soil Screening Levels for Migration to Groundwater**	Frequency of Detects Number of Samples	Range of Detected Sample Concentrations (ppm)	Sample with High Concentration
Toluene										16,000	12		0.007 - 0.015	TP-08A 1-2
Vanadium	NA	NA	NA	NA	NA	NA	370	7100 n	h	550	6,000	21/39	9.00 - 46.40	SB-05-0-0.5
Xylene										410	190		0.017 - 0.025	B6/53A 5-8
Zinc	NA	NA	NA	NA	NA	NA	1500 m	1500 m	h	23,000	12,000	22/39	6.00 - 90.00	B8/S3A 5-7

All concentrations presented in mg/kg or ppm.

c – Health based criteria exceeds 1000 mg/kg maximum for total organic contaminants.
f – Cleanup criteria based on practical quantitative units.
g – Criterion has been recalculated based on new toxicological data.
h – Impact to groundwater values for inorganics will be developed based upon site specific chemical and physical parameters.
i – Original criterion was incorrectly calculated and has been recalculated.
J – Indicates for all chemicals that the reported concentration is estimated.
k – Criterion based on inhalation exposure pathway which yielded a more stringent criterion than the incidental ingestion exposure pathway.
m – Criteria based on ecological (phytotoxicity) effects.
n – Should be evaluated on a site-by-site basis.
N – For organics, this qualifier indicates that there is only presumptive evidence for their presence; for inorganics, the N qualifier indicates that the spiked sample recovery is not within control limits.
NA – Not Applicable.
NE – Not established.
p – Criterion based on the goal that children should be exposed to the minimal amount of lead that is practicable and is reflective of natural background as altered by diffuse anthropogenic pollution. Criterion corresponds to both a median value for urban land which has not been impacted by any local point source of lead and a 90th percentile value for similar suburban land.
P – For pesticides, this qualifier indicates a greater than 25 percent difference for detected concentrations between two GC columns.
q – Criteria was derived from a model developed by the Society for Environmental Geochemistry and Health (SIGH) and was designed to be protective for adults in the workplace.
r – Insufficient data available to calculate impact to groundwater criteria.
RA – Risk Assessment.
X – For organics, this qualifier indicates that the reported value required multiple qualifiers and to see the case narratives did not contain further clarification for this qualifier.
** Based on a default dilution-attenuation factor (DAF) of 20 to account for natural processes that reduce contaminant concentrations in the subsurface.

Table 2-5
Pulverizing Services Site
Selected RAO's and Associated Detected Compounds for the Site

Contaminants	Commercial Site Worker RA PRG 10^{-6}	Commerical Construction Worker RA PRG 10^{-6}
4,4'-DDT	17	165
Aldrin	0.17	3.3
Dieldrin	0.36	3.5
Associated Detected Compounds (PRGs Not Established)		
4,4' - DDE	--	--
4,4'-DDD	--	--
Acetone	--	--
Alpha-BHC	--	--
Aluminum	--	--
Arsenic	--	--
Barium	--	--
Benzo (a) anthracene	--	--
Benzo (a) pyrene	--	--
Benzo(b) fluoranthene	--	--
Benzo (g,h,i)perylene	--	--
Benzo(k) fluoranthene	--	--
Beta-BHC	--	--
bis (2-Ethylhexyl) Phthalate	--	--
Butylbenzyl-phthalate	--	--
Cadmium	--	--
Calcium	--	--
Chromium	--	--
Chrysene	--	--
Cobalt	--	--
Copper	--	--
Delta-BHC	--	--
Di-n-butyl-phthalate	--	--
Endosulfan I	--	--
Endrin	--	--
Fluoranthene	--	--
Hexachloro-benzene	--	--
Indeno (1,2,3-cd) pyrene	--	--
Iron	--	--
Lead	--	--
Lindane	--	--
Malathion	--	--
Manganese	--	--
Mercury	--	--
Methoxychlor	--	--

Table 2-5
Pulverizing Services Site
Selected RAO's and Associated Detected Compounds for the Site

Contaminants	Commercial Site Worker RA PRG 10^{-6}	Commerical Construction Worker RA PRG 10^{-6}
Nickel	--	--
Octachlorod benzo-p-dioxin	--	--
Phenol	--	--
Potassium	--	--
Pyrene	--	--
Selenium	--	--
Sevin	--	--
Sodium	--	--
Thallium	--	--
Vanadium	--	--
Zinc	--	--

Table 2-6
Pulverizing Services Site
Draft Impacted Soil Quantity Estimates
By RAO

	Commercial Site Worker 10^{-6} PRG	Commercial Construction Worker 10^{-6} PRG
Total Estimated Quantity of Impacted Soil (Tons)	13,000	4,400

Section 3

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3.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

Remedial options and technologies for the Pulverizing Services Site were identified using criteria presented in USEPA's Guidance for Conducting RI/FS under CERCLA (USEPA, 1988) and Chapter 26E of New Jersey's Technical Requirements for Site Remediation (NJDEP, 1997). For the purpose of technology screening and development of response measures, Site soils and disposal trench materials are the media of concern. Technologies have been identified to address chlorinated organic pesticides, which have been identified as the primary chemicals of concern at the Site, as indicated in Section 2.0.

Areas of the Site which contain concentrations of the chemicals of concern above the remedial action objectives were identified to determine the extent and magnitude of the contamination. Based on this information, several remedial technologies were identified. However, only a limited number of the technologies were found to be applicable due to Site conditions, future land use considerations, regulatory issues, and technological limitations.

3.1 GENERAL RESPONSE ACTION

General Response Actions are broad remedial approaches capable of meeting the remedial objectives at the Site. Some response actions are sufficiently broad such that they are capable of meeting remedial objectives alone. However, in most cases, combinations of response actions are required to address various Site conditions and to be effective in meeting the remedial goals. The General Response Actions appropriate for the Site are:

- No-Action
- Institutional Controls
- Containment
- Removal
- Treatment
- Disposal

Descriptions of the General Response Actions are provided below:

3.1.1 No-Action

The NCP and CERCLA require the evaluation of a no-action response measure as a basis of comparison with other remedial alternatives. The no-action response measure is used during the risk assessment to project potential future risks at the Site. The no-action response measure is intended to allow comparison of those future risks with the residual risks associated with other response measures.

3.1.2 Institutional Controls

Institutional controls include actions that control human contact with the contamination rather than controlling the contamination present in the media. These actions may be physical, such as fences or barriers, or administrative, including establishment of zoning restrictions, land use restrictions, or notices upon resale or transfer of property title.

3.1.3 Containment

Containment technologies control potential hazards by reducing the ability of a chemical to leave the source and enter the transport medium or by reducing the ability of a chemical to leave the transport medium and contact a receptor. Containment technologies may reduce contaminant mobility, but do not reduce the toxicity or volume of contaminants. These technologies may require monitoring to determine whether remedial measures are remaining protective of human health and the environment.

3.1.4 Removal

Removal technologies refer to methods typically used to excavate and handle soils, wastes, and other materials. Excavation technologies provide no treatment of wastes, but may be employed prior to treatment or disposal technologies.

3.1.5 Treatment

Treatment technologies reduce the volume, toxicity, or mobility of contaminants by biological, physical, thermal, or chemical processes. Treatment technologies may be performed ex-situ or in-situ. Treatment to reduce volume includes extraction procedures to concentrate contaminants. Treatment to reduce toxicity includes methods to destroy or modify the properties of chemical to render it less harmful. Treatment may include methods to modify the physical or chemical properties of the waste to reduce mobility.

3.1.6 Disposal

Disposal technologies are primarily designed to reduce the mobility of contaminants, generally by application of containment technologies. Remedies requiring the off-site transportation and disposal of wastes can only be implemented if wastes are disposed of in a facility operating in compliance with RCRA. Disposal technologies are applicable to both hazardous wastes, which may be disposed of in a RCRA Subtitle C landfill, and non-hazardous wastes, which can be disposed of in a RCRA Subtitle C or D landfill.

3.2 REMEDIAL TECHNOLOGY ANALYSIS

The following Section describes the technologies associated with each General Response Action that have been identified and screened for use at the Site. The following section provides a discussion of the advantages and disadvantages of each technology, a discussion of the risks associated with each technology, and any information regarding past uses of the technology at other sites with similar chemicals of concern. Finally, the section identifies whether each technology will be retained for further consideration in Section 4.0, Development, Detailed Evaluation and Comparative Analysis of Response Measures.

3.2.1 No Action

As the term "no action" implies, no additional remedial activities would be conducted at the Site to address the Site risks. Although this technology assumes an uncontrolled site as a baseline for analysis of other technologies, a security fence was installed between 1987 and 1993 to control access onto the Site. In addition, administrative institutional controls have already been established at the Site in the form of zoning restrictions (the Site is currently zoned "Specially Restricted Industrial").

3.2.2 Institutional Control Technologies

3.2.2.1 Site Security

Site security would include maintaining the security fence around the contaminated areas of the Site and further measures, such as posting signs to warn potential trespassers of the risks related to exposure to the contaminants present in those areas. It is anticipated that this remedial alternative, if not solely selected, may be used in conjunction with the selected remedial technology to control access onto the Site during remedial activities. Therefore, it will be retained for further consideration.

3.2.2.2 Land Use Restrictions

Land use restrictions effectively control exposure to Site contaminants by controlling future Site use. Based on the assumption that the future Site use will be consistent with its current zoning for Specially Restricted Industrial, placement of a land use restriction on the property would further restrict future Site development and prohibit the installation of water supply wells within the boundaries of the Site. It is anticipated that this remedial alternative, if not solely selected, will be used in conjunction with the selected remedial technology to control future Site use. Therefore, it will be retained for further consideration.

3.2.2.3 Environmental Monitoring

Environmental monitoring would include sampling of on-Site soils and groundwater to determine whether contaminant concentrations in Site media have decreased through natural processes such as degradation, flushing and/or natural attenuation. It is anticipated that this remedial alternative, if not solely selected, may be used in conjunction with the selected remedial alternative to control future Site use. Therefore, it will be retained for further consideration.

3.2.3 Containment Technologies

3.2.3.1 Capping

Capping is an effective means of reducing the potential for direct contact with contaminated soils and minimizing infiltration and subsequent leaching of contaminants in underlying soil. Excavation and consolidation of impacted materials is often performed in conjunction with capping to reduce the size of the area requiring a cap. Four capping options are discussed herein: 1) a RCRA cap, 2) a multi-media cap, 3) an asphalt cap, and 4) a soil cover with impermeable geomembrane.

A RCRA cap is a multi-layer cap satisfying USEPA requirements (RCRA Guidance Document, Surface Impoundments, Liner Systems and Freeboard Control, July 1982). The RCRA cap consists of a two-foot compacted clay layer overlain by a high density polyethylene (HDPE) synthetic membrane liner, HDPE synthetic drainage net, and 2 to 3 feet of clean fill and topsoil. The topsoil layer is vegetated to minimize the effects of erosion. A detailed description of a RCRA cap is provided in Section 4.1.2.

A multi-media cap is a simplified version of the RCRA cap, and consists of a 6-inch sand layer overlain by an HDPE liner and synthetic drainage net, 2 to 3 feet of cover soil, and vegetation to resist erosion.

Although RCRA caps and multi-media caps are designed primarily for use in capping landfills where steep grades are present and excessive settlement is expected, RCRA caps may also be used for capping sites where RCRA hazardous wastes have been identified or sites where contaminants remain in place at concentrations which have the potential to impact groundwater.

Asphalt is a low-permeability material that functions in a similar manner as the other caps, but provides a usable area for parking or other future land uses. Typically, two or more layers of asphalt (binder and wearing course) are placed over appropriate subbase layers. An HDPE liner may be placed beneath the subbase to further prevent infiltration of stormwater. If properly maintained, the system eliminates the possibility of contaminants leaching into the underlying Site soils and groundwater. A detailed description of an asphalt cap is provided in Section 4.1.2.

A soil cover with impermeable geomembrane consists of a single layer of soil placed atop an impermeable geomembrane liner. The soil cover serves to isolate receptors from exposure to surface contamination, as does the geomembrane, which also prevents the infiltration of precipitation and stormwater runoff into the Site soils beneath the geomembrane. If properly maintained, the system eliminates the possibility of contaminants leaching into the underlying Site soils and groundwater. A detailed description of a soil cover with impermeable geomembrane is in Section 4.1.2.

Capping the impacted areas of the Site would provide containment and reduce potential surface contact hazards posed by contaminated soils. A cap would also be effective in minimizing infiltration of stormwater and subsequent leaching of contaminants into the underlying soil and groundwater.

All four types of caps could be constructed on the Site. However, construction of the RCRA cap and the multi-media cap would most restrict future land use due to the thickness of these types of caps (typical RCRA cap is 5 to 7 feet thick, and a typical multi-media cap is 3 to 4 feet thick).

The RCRA cap has been retained as a contingency technology in the event that RCRA hazardous wastes are encountered and removal of these materials is not feasible or practical. The RCRA cap has also been retained because it is applicable for the capping of soils containing contaminants in concentrations which have the potential to impact groundwater. The multi-media cap also does not provide any added benefit over a soil cover with geomembrane or an asphalt cap, assuming that these types of caps are adequately maintained. Therefore, the multi-media cap has been eliminated from further consideration.

Both the asphalt cap and the soil cover provide exposure protection and prevent infiltration of stormwater runoff into the underlying soils. Since the soil cover and asphalt caps offer protection to potential receptors by preventing exposure to surface contamination, and since they provide the most flexibility with regard to future land use, the soil cover with impermeable geomembrane and asphalt cap (with or without impermeable geomembrane) have been retained for further consideration.

3.2.4 Removal Technologies

3.2.4.1 Excavation

The technology typically used for removal of contaminated soil and trench material is excavation. The excavated soil would be consolidated elsewhere on site, or treated or disposed of off site, and the excavated area would be backfilled with clean fill or treated Site soils. Prior to initiating excavation activities, the horizontal extent of contamination in the soil and trench material would be delineated using surveying equipment and scaled maps and drawings.

Excavation of soils and trench materials would be performed using standard earthmoving equipment which is readily available. Although the operations would be conducted in a manner which minimizes the generation of dust, there are risks associated with the potential for inhalation of particulate matter during the soil and trench material excavation activities. Because private residences and a food processing facility adjoin the property boundary, the sensitivity to the risks associated with dust generation is particularly acute at this Site. Therefore, appropriate health and safety and air monitoring measures would be required in order to monitor the generation of dusts during the excavation activities and to determine the need for implementation of dust suppression techniques.

Because removal of trench materials may require excavation at or below the groundwater table, there would be additional risks associated with this activity, including hazards associated with instability of sidewalls. Therefore, appropriate health and safety measures would be required to ensure the protection of Site workers.

Because excavation: 1) Allows for consolidation of contaminated media within the Site boundaries; 2) Is an effective means by which to remove contaminated materials from the Site; 3) Is required for all ex-situ technologies, it will be retained for further consideration.

3.2.5 On-Site, Ex-Situ Treatment Technologies

3.2.5.1 Anaerobic Bioremediation

This technology involves the metabolization of contaminants using microorganisms in the absence of oxygen. It requires the excavation of contaminated soil and trench material and placement in on-Site "bio-piles". The bio-piles are constructed in such a way as to inhibit the infiltration of oxygen. The necessary nutrients are added to the bio-pile to stimulate the microbial degradation of the chemicals of concern. Monitoring is performed to ensure that the bio-piles remain oxygen-free, and the bio-pile is periodically sampled to monitor the progress of the degradation of the contaminants within the soil and trench material.

Anaerobic bioremediation has been proven in laboratory and pilot scale tests to degrade chlorinated pesticides in contaminated media and is currently undergoing full-scale evaluation at a site with similar COCs (Record of Decision, Summary of Remedial Alternative Selection, Prepared by USEPA for the Stauffer Management Company Site, Tampa, Florida). However, the success of this technology is highly dependent upon various factors such as nutrient availability and moisture content of the media. Therefore, laboratory treatability evaluations and field-scale pilot tests would be required to determine the effectiveness of this technology in treating the Pulverizing Services Site media. Although treatment of media using this technology typically proceeds slowly relative to other technologies, it will be retained for further consideration as it has been proven to be effective in pilot-scale tests performed at other sites.

3.2.5.2 Aerobic Bioremediation

This technology is similar in nature to anaerobic bioremediation, but the remediation activities are performed in the presence of oxygen. The success of this technology is highly dependent on the availability of oxygen in the media being treated. Laboratory-scale tests conducted for similar COCs have determined that aerobic bioremediation processes are not effective in degrading chlorinated pesticides. Therefore, this technology has been eliminated from further consideration.

3.2.5.3 Stabilization

This technology involves excavation of impacted media, removal of debris not appropriate for stabilization, ex-situ mixing of media and reagent within a vessel, and curing. Stabilization can also be performed in-situ, thereby avoiding the need to excavate the contaminated materials. In effect, a protective coating is applied over the impacted media to reduce the mobility and solubility of the contaminants. This technology does not alter the chemistry of the contaminants or reduce their toxicity.

Since pesticide compounds are inherently designated to bind to soil particles, stabilization provides no substantive, additional benefits. Therefore, this technology has been eliminated from further consideration.

3.2.5.4 Low Temperature Thermal Desorption

This technology involves the excavation and on-Site thermal treatment of soils and trench materials at temperatures ranging from 700 degrees Fahrenheit to 1,000 degrees Fahrenheit. As the soil is heated in on-Site treatment units, the pesticides are desorbed from the Site media and thermally degraded. Residual pesticides may exit the process in the rinse water, off-gas, and process residual (treated soil). A limited bench-scale treatability study performed by Focus Environmental of Oak Ridge, Tennessee has indicated that this technology may be effective in treating Site soils and trench materials.

Short-term risks associated with this technology include significant material handling requirements, noise, and dust generation, and the potential for inhalation of residual contaminants which may be present in the treatment off-gas. These risks are particularly undesirable due to the residential land use in the vicinity of the Site and the presence of a neighboring food processing facility. Although off-gas treatment technologies are available, a worst-cast release scenario involving the failure of emissions control equipment would result in exposure of nearby residents and workers at the neighboring food processing facility.

Concerns associated with application of this technology at the Pulverizing Services Site include reports of explosions in the low-temperature thermal desorption units when treating soils that contain sulfur, a material that was widely used at the Pulverizing Services Site, and the potential for corrosion of and subsequent damage to treatment equipment by hydrochloric acid which may be generated when treating chlorinated compounds such as those found at the

Site. Corrosion of treatment equipment would increase the risk of equipment failure, thereby jeopardizing worker safety and increasing the potential for worker and public exposure.

Other concerns associated with application of this technology at the Pulverizing Services Site are discussed in the letter from PPG to USEPA, dated May 28, 1997, which is included as Attachment A. Due to these concerns, and in consideration of the ongoing discussions between PPG and USEPA, on-site application of this technology has been eliminated from further consideration.

3.2.5.5 Dechlorination

This technology involves excavation of soils and on-site, ex-situ treatment. The process involves using calcium-generated solvated electrons in solvents such as ammonia to selectively strip halogens from halogenated organic compounds in soil, converting the compounds to calcium halides and hydrocarbon residuals. Non-halogenated hydrocarbons are then removed from the soil via soil washing as solvent (e.g., ammonia) recovery is conducted. The dechlorination process is still in the research phase. Although some success has been achieved in treating halogenated organic pesticides in carefully controlled, laboratory-scale experiments, the technology has not been proven effective for such compounds on a pilot-scale or fully operational-scale.

Because the effectiveness of this technology in treating chlorinated organic pesticides is unproven on both pilot and operational scales, this technology has been eliminated from further consideration.

3.2.5.6 Soil Washing

This technology is used to reduce the volume of soils to be treated or disposed of by removing source material through physical particle size separation. Contaminated soils are excavated, screened to remove large debris unsuitable for washing, and mixed with water. To enhance the removal of non-water soluble constituents, surfactants or detergents may be added to the wash water. Contamination is removed from the larger grain-sized material, but remains in finer material. Use of this technology would require a secondary treatment and/or disposal step for wash water and fines.

The applicability of soil washing is dependent upon the contaminants to be removed and the soil properties. This technology is most applicable for soils composed of sands and loose gravel. Significant volume reduction may not be achieved for clayey or silty soils, which are comprised mostly of fines. Since the soils to be treated at the Site are composed mostly of silty sands and clays, the effectiveness of the soil washing technology for use at the Pulverizing Services Site is uncertain. Therefore, this technology has been eliminated from further consideration.

3.2.6 On-Site, In-Situ Treatment

3.2.6.1 Chemical Oxidation

This technology consists of the in-situ injection of hydrogen peroxide into the affected Site media along with a catalyst in order to oxidize the organic constituents present in the media. Through this process, the organic constituents are reduced to carbon dioxide and water.

The overall effectiveness of this technology is dependent upon the homogeneity of the soil matrix and the percent of silts and clays, both of which have been documented to reduce its effectiveness. Additionally, because the oxidation occurs within the first few days following injection, organic compounds that are bound in the soil matrix may not be available for treatment; thus additional treatment to remove these materials may be required. The reaction is exothermic and the large amounts of heat generated have been shown to sterilize the subsurface. Risks associated with this technology include inhalation of vapors released through the ground surface during soil oxidation by Site workers, nearby residents, and employees of the neighboring food processing facility.

In addition, large volumes of hydrogen peroxide would be required to fully implement the process at a site of this size. The potential for an uncontrolled release (i.e., spill, tank or line rupture) is another risk associated with this technology.

Due to the potential risks associated with its implementation and the high degree of dependence on Site conditions, this technology has been eliminated from further consideration.

3.2.6.2 Phyto-Remediation

This technology involves planting indigenous species in contaminated soils to biodegrade the pesticide compounds. The soil is prepared using standard farm equipment, species appropriate for the uptake of the constituents of concern are planted, and macro/micro nutrients are added to stimulate plant growth and root development.

Laboratory studies have shown that microbial activities which occur within the root zones of plants have been effective in degrading pesticides. However, this technology would require significant laboratory and pilot-scale studies to determine the appropriate plant species and microbes. Studies would also be required to determine if the metabolized compounds could become bio-available, thereby posing an ecological risk. Phyto-remediation of pesticide contaminants is not field-proven, and the time period required to achieve remedial goals is unknown. Therefore, this technology has been eliminated from further consideration.

3.2.7 Disposal

3.2.7.1 Off-Site Landfilling

This technology would involve excavation of the trench materials and soils that are impacted above the Site risk-based preliminary remediation goals, and transportation of the excavated materials to an off-Site RCRA Subtitle C or D landfill. This technology can be implemented using any one of a number of qualified contractors, standard earthmoving techniques, and permitted landfill disposal sites. The disadvantages of this technology are the potential exposure risks associated with the handling of significant quantities of contaminated materials, and generation of dust. However, recent experience at the Site indicates that these risks can be minimized through the use of conventional dust suppression techniques and appropriate health and safety measures.

Other concerns associated with this technology include the potential for accidents involving trucks carrying contaminated materials resulting from a marked increase in heavy truck traffic through a substantially residential area. Such increased truck traffic would also present a general nuisance to the surrounding residential community.

Since this technology has been demonstrated to be effective, it has been retained for further evaluation.

3.2.8 Off-Site Treatment

3.2.8.1 Incineration

Incineration involves reducing or eliminating the toxicity of the waste through thermal destruction of the hazardous constituents. This technology could be implemented using a qualified Site work contractor, standard earthmoving techniques, and an incinerator permitted for the destruction of pesticides. Excavation activities would result in handling significant quantities of contaminated materials, and generation of dust. The short-term risks associated with this technology includes the potential inhalation of dust generated. However, recent experience at the Site indicates that these risks can be minimized by conventional dust suppression techniques and appropriate health and safety measures.

Other concerns associated with this technology include the potential for accidents involving trucks carrying contaminated materials resulting from a marked increase in heavy truck traffic through a substantially residential area. Such increased truck traffic would also present a general nuisance to the surrounding residential community.

The disadvantages of off-site incineration are that few appropriate incinerators exist, those in operation are located a considerable distance from the Site, and the technology is costly to implement. However, since this technology has been demonstrated at several sites to be effective in treating pesticides, and may be appropriate should RCRA hazardous wastes be identified at the Site, off-site incineration has been retained for further evaluation.

3.2.8.2 Low Temperature Thermal Desorption

This technology involves excavation of contaminated media, transportation to an appropriate, off-site permitted low-temperature thermal desorption facility, and off-site waste treatment. Contaminated media are subjected to temperatures ranging from approximately 700 degrees Fahrenheit to 1,000 degrees Fahrenheit. As the media is heated in the treatment units, the pesticides are desorbed from the site media and thermally degraded.

PPG resurveyed potentially applicable LTTD facilities in non-residential, off-site locations, and identified four facilities located within a reasonable distance of the Site. None of the facilities are capable of handling RCRA hazardous wastes. One of the facilities is unable to process greater than 20 mg/kg chlorinated compounds and would, thus, be unable to address the bulk of the Site media. The second facility is capable of handling up to 1,000 mg/kg of chlorinated compounds, and the third facility has indicated that they can treat up to 30,000 ppm total contaminants. The fourth facility indicated that they should be able to treat the majority of the site soils under their existing permits.

Other concerns associated with this technology include the potential for accidents involving trucks carrying contaminated materials resulting from a marked increase in heavy truck traffic through a substantially residential area. Such increased truck traffic would also present a general nuisance to the surrounding residential community.

Because LTTD has been demonstrated to be effective in treating pesticide-impacted media, off-site application of the technology will be retained, pending the collection of further information on the progress of the facility under construction and the site-specific applicability of the remaining facilities.

3.2.8.3 Chemical Oxidation

This technology involves excavation of contaminated media, transportation to an appropriate, permitted waste treatment, storage and disposal facility, and ex-situ, off-site waste treatment. Organic compounds contained in the waste are chemically oxidized to yield carbon dioxide, nitrogen, water, salts, and simple organic acids.

PPG has not identified a commercially viable off-site chemical oxidation facility capable of treating chlorinated organic pesticides and has identified a number of other options that can be implemented in the event that small quantities of RCRA hazardous waste are encountered. Therefore, this technology has been eliminated from further consideration.

3.3 SUMMARY

Based on the information described above, the No Action alternative and seven technologies will be retained for detailed evaluation. These technologies include:

- Institutional Controls
- Excavation
- Capping - Soil Cover with Impermeable Geomembrane, Asphalt Cap, RCRA Cap
- On-Site Anaerobic Bioremediation
- Landfilling
- Incineration
- Off-Site Low Temperature Thermal Desorption

Figure 3-1 presents a summary of the screening process which was used in determining the technologies to be retained for assembly and detailed evaluation of response measures.

Figure 3-1
Summary of Remedial Technologies Screening Process
Pulverizing Services Site
Moorestown, New Jersey

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	Not Applicable	No Action	Required for consideration by NCP
Institutional Actions	Site Access and Use Restrictions	Site Fencing	Security fence installed around contaminated areas, warning signs installed	Potentially applicable
		Land Use Restrictions	Land use restrictions would be recorded in the property deed to prohibit activities that might cause exposure to site contaminants	Potentially applicable
		Environmental Monitoring	Sampling of on-site soils, groundwater and/or air	Potentially applicable

ppgchart

Figure 3 1
Initial Screening of Remedial Technologies
Pulverizing Services Site
Moorestown, New Jersey

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Removal	Excavation	Excavation	Removal of contaminated soil using standard earthmoving equipment, backfilled with clean or treated soil	Potentially applicable
On site Treatment	Ex situ Treatment	Anaerobic Bioremediation	Degradation of pesticides using anaerobic bacteria	Potentially applicable
		Aerobic Bioremediation	Degradation of pesticides using aerobic bacteria	Technology not proven to be effective on site contaminants relative to anaerobic bioremediation
		Low Temperature Thermal Desorption	Thermal desorption and degradation of pesticides at temperatures less than 1,000 degrees F	Eliminated due to a number of concerns, including, but not limited to, the sensitive location of the Site, problems associated with operation of the system 24 hours per day (i e , noise and dust generation), space considerations and potential for off gas releases.
		Stabilization	Mixing fixing agents with soils to reduce mobility and solubility	Long term effectiveness of stabilizing pesticide impacted soils is questionable Additives have not been proved to permanently immobilize organic based contaminants Fine particles in the soil matrix will also eventually weaken chemical bonds of the stabilizing agent
		Dechlorination	Solvated electrons strip halogens from pesticides, and non halogenated hydro carbons are removed via soil washing	Unproven on an operational scale Only pilot scale testing has been completed
		Soil Washing	Use of water and surfactant mixture to remove contaminants from larger grain media	Technology would not achieve sufficient volume reduction. Boring logs from site indicate 35 50% of site soil is comprised of fines which would require disposal after treatment Also, extensive amounts of impacted process water require disposal

Process Option Eliminated From Further Consideration

ppgpg2

Figure 3-1
Initial Screening of Remedial Technologies
Pulverizing Services Site
Moorestown, New Jersey

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
On site Treatment	In-situ Treatment	Chemical Oxidation	Injection of hydrogen peroxide along with a catalyst to oxidize organics in soil	This technology has not been proven on a full-scale basis to effectively treat pesticide-impacted soils
		Phytoremediation	Planting of indigenous plants to pro vide for uptake constituents or to lower water table during a remedial action	Unproven on an operational scale for treatment of pesticide-impacted soils. Also, not effective for treatment of subsurface soils.
Off-site Disposal	Landfilling	Landfilling	Untreated soil excavated & transported to a RCRA Subtitle C or D landfill	Potentially Applicable
Off-site Treatment	Thermal Treatment	Incineration	Thermal destruction of pesticides in hazardous waste incinerator	Potentially Applicable
		Low Temperature Thermal Desorption	Thermal desorption & degradation of pesticides at temperatures less less than 1,000 degrees Fahrenheit	Potentially applicable. Additional information is needed to confirm that off-site facilities are permitted to treat levels of pesticides detected at the site
	Chemical Treatment	Chemical Oxidation	Organic compounds are oxidized to reduce toxicity	Effectiveness in treating soils with higher concentrations of pesticides is unproven

Process Option Eliminated From Further Consideration

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Figure 3 1
Summary of Remedial Technologies Screening Process
Pulverizing Services Site
Moorestown, New Jersey

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Containment	Capping	RCRA cap	Multi-layer cap satisfying EPA requirements placed over contaminated areas	Potentially applicable should RCRA hazardous waste or soils containing contaminants in concentrations which have the potential to impact groundwater be identified, and removal of these materials is not feasible or practical.
		Multi media cap	Multi media cap (several soil layers and HDPE liner) placed over contaminated areas	Eliminated because multi media cap would not satisfy the requirements of a RCRA cap should a hazardous waste require containment. In addition, since the primary purpose of a non RCRA cap is to prevent direct contact with migration of COCs, the multi media cap does not provide any added benefit over soil cover with geomembrane (SCw/G).
		Asphalt cap	Placement of a layer of asphalt over contaminated areas	Potentially applicable. Asphalt cap is effective in preventing direct contact w/surface contaminants, and, if maintained, is is effective in preventing infiltration of stormwater. Due to land use considerations, areas subjected to an asphalt cap may be limited to certain areas on site.
		Soil Cover With Geomembrane	Single layer of uncontaminated soil and impermeable geomembrane place over contaminated areas	Potentially applicable. SCw/G is effective in preventing direct contact w/surface contaminants, and, if maintained, is effective in preventing infiltration of stormwater.

[shaded box] Process Option Eliminated From Further Consideration

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Section 4

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4.0 DEVELOPMENT, DETAILED EVALUATION, AND COMPARATIVE ANALYSIS OF RESPONSE MEASURES

4.1 DEVELOPMENT OF RESPONSE MEASURES

Typically, after applicable technologies are identified and screened, they are merged into comprehensive response measures. The response measures are then screened based on their overall effectiveness, implementability, and order-of-magnitude costs. This screening process is used primarily to reduce the number of response measures that are maintained for detailed analysis.

In this case, however, due to the stringent remedial action objectives used to identify and screen potential technologies, only a limited number of response measures can be developed from the remaining technologies. Therefore, response measures screening will not be performed and all developed response measures will be evaluated in detail.

This section presents descriptions of each potential response measure, including the following details where applicable:

- A description of appropriate treatment and disposal technologies, as well as any permanent facilities required for implementation.
- Required engineering considerations (e.g., treatability study, pilot treatment facility, additional studies needed to proceed with final remedial design).
- Environmental and human health impacts and methods for mitigating or eliminating any adverse impacts.
- Operation and maintenance/monitoring requirements of the completed remedy.
- Temporary storage requirements and soil/segregation/waste characterization plans.
- Requirements for health and safety plans during remedial implementation.
- A discussion of how the alternative could be segmented into areas to allow implementation of differing phases of the response measure.
- A discussion of the Federal, State, and local permits that are anticipated to be necessary.
- The estimated time required for implementation.
- Measures to control adverse air quality impacts that may occur during implementation of the response measure.

Utilizing the representative technologies selected in the technology screening section, the following potential response measures were developed for detailed evaluation.

1) No Action
2) Selective Excavation, Consolidation, and Capping

3A) Excavation, On Site, Ex-Situ Anaerobic Bioremediation, and Off-site Landfilling/Incineration

3B) Excavation, On-site Anaerobic Biotreatment, Off-site Landfilling/Incineration, and Capping

4A) Excavation, Off-site Low Temperature Thermal Desorption (LTTD), and Off-site Landfilling/Incineration

4B) Excavation, Off-site LTTD, Off-site Landfilling/Incineration, and Capping

5A) Excavation, Off-site Incineration/Landfilling

5B) Excavation, Off-site Incineration/Landfilling and Capping

Response Measures 2, 3B, 4B, and 5B would include institutional controls such as enactment of land use restrictions to control future use of the Site and thereby further limit the potential for exposure.

4.1.1 Response Measure 1: No Action

This Response Measure is required as a basis for comparison with other Response Measures. No additional remedial activities would be performed as part of this response measure. However, several physical and administrative institutional controls have already been implemented at the Site which have served to reduce the potential for exposure to Site contaminants. For examples, the current Site zoning (Specially Restricted Industrial) is an administrative institutional control which serves to restrict future Site use and, thereby, limit the potential for exposure. As an additional measure of protectiveness, a Site security fence was installed between 1987 and 1993 to control access onto the Site.

4.1.2 Response Measure 2: Selective Excavation, Consolidation, and Capping

This Response Measure would involve construction of a soil cover with an impermeable geomembrane, an asphalt cap, and/or a RCRA cap over designated impacted areas of the Site to reduce the potential for direct contact with contaminated media and minimize infiltration of stormwater into the underlying soils. This response measure would include the following major elements:

- Design, permitting, and contractor and materials procurement.
- Mobilization of required personnel, facilities, and equipment.
- Site preparation, including inspection and repair of the Site security fence, construction of an equipment staging area, decontamination area, material stockpile area, and implementation of erosion and sedimentation controls (drainage swales, retention pond, etc.).
- Sealing, backfilling, and closing the Building 5 Trench.
- Consolidation of materials from Areas B and C, as well as outlying portions of Area A, in designated portions of Area A. A RCRA cap would be constructed over areas of hazardous waste, if encountered, and

consolidated soils containing concentrations in excess of the RA 10^{-6} Construction Worker Scenario.

- Non-hazardous soils and soils containing concentrations less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria will be excavated, consolidated within the disposal trench area and covered using a soil cover or asphalt cap, as described in subsequent sections.
- Soil Cover construction as follows: 1) Clearing and grubbing; 2) Grading and filling to create a 5 percent slope for positive drainage; 3) Placement of a protective cushion geotextile over the area to be covered to provide a smooth, even surface for placement of the impermeable geomembrane, and to protect the geomembrane from tearing; 4) Installation of the impermeable geomembrane; 5) Placement of a layer of protective cushion geotextile over the geomembrane to protect it during compaction of the natural soil material; 6) Placement of the soil cover over the geotextile in 6-inch lifts and compaction to 90% of Standard Proctor. The soil cover would include the use of clean soils generated during the implementation of the erosion and sedimentation controls; and 7) Final grading and seeding.
- RCRA cap construction over areas of hazardous waste, if encountered, and soils containing concentrations in excess of the RA 10^{-6} Construction Worker Scenario as follows: 1) clearing and grubbing; 2) grading and filling to create a 5% slope for positive drainage; 3) placement of a 2-foot thick compacted clay layer installed in 6-inch lifts; 4) installation of a high-density polyethylene (HDPE) synthetic membrane; 5) placement of a HDPE synthetic drainage net; 6) addition of 2-3 feet of certified clean fill and top soil; and 7) final grading and seeding with grass to resist erosion.
- Asphalt cap construction, if necessary, as follows: 1) clearing and grubbing; 2) grading and filling to create a 5% slope for positive drainage; 3) installation of a 6-inch sand or earth fill layer; 4) placement of a 60-mil HDPE liner and synthetic flow net for drainage (optional); 5) placement of a layer of filter fabric for separation of the overlying aggregate from the drainage layer (if necessary); 6) placement of a 12-inch layer of sand and gravel; and 7) placement of a 3 1/2-inch layer of asphalt.
- Restoration of wetland areas, as necessary, that may be disturbed by Site activities.
- Disposal of work-related residuals (i.e., decontamination waters, PPE, etc.).
- Site cleanup and demobilization.
- Periodic inspection and maintenance of the RCRA and asphalt caps and soil cover.
- Enactment of Institutional Controls (i.e., land use restrictions and environmental monitoring).

Figure 4-1, found at the end of this document, presents the areas to be excavated and capped, as well as the preliminary approximate locations of staging areas and clean haul roads which will be constructed.

Initial phases of the work would consist of design and permitting, and preparation of a Site-specific health and safety plan. Critical design and engineering considerations would include:

- Design to minimize settlement and erosion;
- Stormwater and sedimentation controls;
- Design-life of the soil cover and caps; and
- Effects of environmental factors on the soil cover and caps.

Permits which may be required include a general stormwater permit (New Jersey Pollutant Discharge Elimination System), and a wetlands disturbance permit. The Site-specific health and safety plan would outline the physical and chemical hazards associated with the work to be performed at the Site and will serve as the instrument of control for ensuring the health and safety of personnel working on the Site. The health and safety plan would also outline the air monitoring program that will be implemented during the construction activities to ensure that a safe working environment is maintained. The health and safety plan would also provide action levels that would dictate the need for implementation of air emissions controls (i.e., dust suppression).

The first phase of the response measure implementation would include mobilization of the required personnel, equipment, and facilities, and Site preparation. During the Site preparation task, the existing fence would be inspected and repaired as necessary to limit access to the Site during remedial activities to authorized personnel. A vehicle decontamination pad would be built to allow for the decontamination of heavy equipment used on Site during construction activities. A material stockpile and staging area would be constructed to provide an area for storage of soils, materials, and miscellaneous equipment to be used in constructing the caps and soil cover. A "clean" access road would be constructed on Site to allow the trucks carrying soil and materials to enter and exit the Site without passing through a decontamination process.

Following Site preparation, clearing and grubbing of the Site would occur as necessary. Next, materials from Areas B and C and outlying locations of Area A would be excavated and consolidated within the designated portions of Area A. Construction of the caps would then occur. This work would include removal of large debris from the Site areas to be capped/covered, grading and filling to create 5 percent slope for positive drainage, and construction of the caps and soil cover as described above. To the extent possible, on-site soils excavated during construction of erosion and sedimentation controls (i.e., drainage swales and detention pond) in clean areas of the site will be used for construction of the soil cover. Standard dust suppression techniques would be used during the remedial construction activities to mitigate the potential for releases of contaminated dust.

Once the soil cover and RCRA caps have been constructed, these areas will be seeded to mitigate the effects of erosion. Surface runoff from the soil cover/caps would be directed as necessary through appropriate drainage swales and culverts. Runoff collection and retention would be considered during the design phase to comply with all location- and action-specific ARARs, and could consist of stormwater conveyance systems ranging from lined ditches and culverts to detention ponds. A perimeter service road would also be constructed to allow for access to the covered area to perform required maintenance activities. The final phase of the work would involve restoration of wetland areas, if necessary, disturbed by Site activities, Site cleanup and demobilization.

Operation and maintenance activities to be performed would include periodic inspection of the cover/caps, removal of foreign objects that could damage the cover/caps, maintenance of the vegetative stand, and re-vegetation as necessary. Maintenance of the vegetative cover will include removal of any trees and shrubs to prevent their roots from damaging the subsurface impermeable geomembrane. Maintenance of the asphalt cap would include resealing, repair of cracks, and reapplication of asphalt, as necessary.

This response measure would also involve enactment of institutional controls, including land use restrictions and environmental monitoring. The institutional controls are intended to control human contact with the contaminated media, as a supplement to the response measure. The land use restrictions control exposure to Site contaminants by controlling future Site use through restrictions on property development and prohibition of installation of water supply wells within the property boundaries.

4.1.3 Response Measure 3A: Excavation; On-Site, Ex-situ Anaerobic Biotreatment; Off-Site Landfilling/Incineration

This response measure would involve: Excavation of the Site soils and trench materials that contain concentrations of the chemicals of concern in excess of the Remedial Action Objectives (RAOs); off-site disposal of less impacted, non-listed soils at a permitted Subtitle C or D landfill; ex-situ, on-site anaerobic bioremediation of remaining soils and RCRA hazardous wastes (if encountered) with concentrations which treatability studies indicate are amenable to this technology; and off-site treatment of RCRA hazardous wastes which cannot be bioremediated at a permitted incinerator. Treated soils and media would be backfilled into the previously excavated areas. This Response Measure also offers the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the treatment process proves ineffective.

The RAO applicable to this Response Measure will be the RA 10^{-6} Commercial Site Worker Criteria. This RAO is consistent with the applicable ARARs, TBCs, local ordinances, and future Site use scenarios.

This response measure would include the following major elements:

- Bench-Scale treatability study and a field pilot-scale test.
- Design and permitting.
- Selection of treatment and disposal facilities.
- Mobilization of required personnel, facilities, and equipment.
- Site preparation, including inspection and repair of the Site security fence, construction of an equipment and material staging area, decontamination

area, Site clean access road, and implementation of erosion and sedimentation controls.

- Sealing, backfilling, and closing of the Building 5 Trench.
- Construction of above-ground, on-Site bioremediation cells or units and temporary structures to contain the Site soils to be treated (includes off-gas collection and treatment system). Based on implementation of bioremediation treatment processes at other Sites, leachate generation is expected to be minimal. However, the need for leachate collection and treatment will be assessed during the pilot-scale studies.
- Excavation of soils exceeding the RAO.
- Segregation/classification of excavated soils, as appropriate, based on treatment/disposal requirements.
- Confirmatory sampling to ensure that soils exceeding the RAO have been excavated.
- Placement of the appropriate soils in the on-site cells for treatment. Addition of nutrients and other additives to stimulate biological activity, and sealing of the treatment cells.
- Loading and transportation of remaining appropriate soils to off-site treatment/disposal facilities.
- Backfill of soils treated via LTTD into the excavated areas and addition of clean fill to return the Site to its original grade.
- Restoration of wetland areas, if any, which were disturbed by Site activities.
- Disposal of work-related residuals (i.e., decontamination waters, PPE, etc.).
- Site cleanup and demobilization.

Figure 4-2, found at the end of this document, presents the areas to be excavated, as well as the preliminary approximate locations of the bioremediation cells, staging area, and clean haul roads which will be constructed.

As discussed during the technology screening analysis, bioremediation has been demonstrated to be successful in degrading chlorinated pesticides at other sites. However, applicability of the technology to the Pulverizing Services Site would need to be verified through a series of bench- and pilot-scale treatability studies. The goal of the bench-scale study is to determine the general effectiveness of the technology in reducing contaminant concentrations to acceptable levels in Site media and to provide base-level design parameters for full-scale implementation. Following a successful bench-scale study, a pilot-scale study would be conducted on Site to verify the technology's effectiveness under field conditions. Due to the anaerobic nature of the process, the bench- and pilot-scale studies are estimated to require approximately five months each to complete, resulting in an study duration of nearly one year.

Upon completion of successful treatability testing, remedial design and permitting would occur. Critical design considerations include incorporation of bench- and pilot-scale study results, design of the treatment cells or units, and design of an off-gas collection and treatment system. Permits which may be required include a general stormwater permit (New Jersey Pollutant Discharge Elimination System), a wetlands disturbance permit, and air emissions permit for discharge of treatment process off-gases.

Prior to initiation of the work, a Site-specific health and safety plan would be prepared. The Site-specific health and safety plan would outline the physical and chemical hazards associated with the work to be performed at the Site and will serve as the instrument of control for ensuring the health and safety of personnel working on the Site. The health and safety plan will also outline the air monitoring program that will be implemented during the construction activities to ensure that a safe working environment is maintained. The health and safety plan will also provide action levels that will dictate the need for implementation of air emissions controls (i.e., dust suppression).

The first phase of the implementation would include mobilization of the required personnel, equipment, and facilities, and Site preparation. During the Site preparation task, the existing fence would be inspected and repaired as necessary to limit access to the Site during remedial activities to authorized personnel only. A vehicle decontamination pad would be built on Site to allow for the decontamination of heavy equipment used on Site during construction activities. A staging area would be constructed to provide adequate storage capacity for excavated soil and miscellaneous equipment and supplies.

Following Site preparation, the soil treatment cell(s) would be constructed on a level area of the Site which will allow for access to monitor the progress of the treatment. Depending on access requirements, Building 29 could be used as a staging area for the treatment piles. The cells would provide an area where the treatment process would occur and would be equipped with an off-gas collection and treatment system. The cells would be constructed so as to prohibit the infiltration of oxygen into the bio-piles.

Soil that contains concentrations of the chemicals of concern in excess of the RAOs would be excavated. For cost estimating purposes only, it has been assumed that materials which contain less than 500 ppm of total pesticides will be disposed of off site in a permitted Subtitle C or D landfill. Material containing between 500 ppm and 1,000 ppm of total pesticides will be biotreated on site. Should the technology prove unsuccessful, this response measure offers an appropriate off-site treatment/disposal facility as a contingency measure. If RCRA hazardous wastes are identified which cannot be bio-remediated, they will be treated off site at a permitted RCRA incinerator. Based on data provided in the Phase I and Phase II Site Investigation Reports, approximately 13,000 tons of material would require excavation and remediation. Due to the large volume of soil to be treated on site, it is expected that the process will require multiple phases to complete.

A confirmatory sampling program would be implemented to provide segregation data and quality assurance for the excavation program. Upon completion of excavation, samples would be collected from the walls and base of the excavation and analyzed for pesticides. If analytical results from the confirmatory samples indicate that residual concentrations exceed the RAOs for the chemicals of concern, additional excavation would be performed followed by additional confirmatory sampling. Dust control measures would be required during the excavation activities to reduce the potential for release of contaminated particulate matter.

The final phase of work would consist of restoring any wetland areas, as necessary, which may be disturbed by Site activities, final Site clean-up, and fine grading and seeding to mitigate the effects of erosion.

4.1.4 Response Measure 3B: Excavation; On-Site, Ex-situ Anaerobic Biotreatment; Off-Site Landfilling/Incineration and Capping

This response measure would involve: Excavation of the Site soils and trench materials that contain concentrations of the chemicals of concern in excess of RAOs; off-site disposal of less impacted, non-RCRA hazardous wastes at a permitted Subtitle C or D landfill; ex-situ, on-site anaerobic bioremediation of soils and RCRA hazardous wastes (if encountered) with concentrations which treatability studies indicate are amenable to this technology; off-site treatment of RCRA hazardous wastes which cannot be bio-remediated at a permitted incinerator; and consolidation of soils from Areas B, C and outlying regions of Area A into the former disposal trench area, and the covering of the backfilled trench area with either a soil or asphalt cap. The soils to be backfilled into the former disposal trench area and covered would contain contaminant constituents less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria. Soils and media treated via bioremediation would be backfilled into the previously excavated areas. This Response Measure also offers the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the treatment process proves ineffective.

The applicable RAOs for this Response Measure will be the RA 10^{-6} Construction Worker Scenario and the RA 10^{-6} Commercial Site Worker Criteria. These RAOs are consistent with the applicable ARARs, TBCs, local ordinances, and future site use scenarios.

This response measure would include the following major elements:

- Bench-Scale treatability study and a field pilot-scale test.
- Design and permitting.
- Selection of treatment and disposal facilities.
- Mobilization of required personnel, facilities, and equipment.
- Site preparation, including inspection and repair of the Site security fence, construction of an equipment and material staging area, decontamination area, Site clean access road, and implementation of erosion and sedimentation controls.
- Sealing, backfilling, and closing of the Building 5 Trench.
- Construction of above-ground, on-site bioremediation cells or units and temporary structures to contain the Site soils to be treated (includes off-gas collection and treatment system). Based on implementation of bioremediation treatment processes at other Sites, leachate generation is

expected to be minimal. However, the need for leachate collection and treatment will be assessed during the pilot-scale studies.

- Excavation of soils exceeding the RA 10^{-6} Construction Worker Scenario RAO.
- Segregation/classification of excavated soils, as appropriate, based on treatment/disposal requirements.
- Confirmatory sampling to ensure that soils exceeding the RAO have been excavated.
- Placement of the soils in the applicable concentration range in the on-Site treatment cells. Addition of nutrients and other additives to stimulate biological activity, and sealing of the treatment cells.
- Loading and transportation of remaining appropriate soils to off-site treatment/disposal facilities.
- Consolidation in the trench area of soils containing concentrations greater than the RA 10^{-6} Commercial Site Worker Criteria but less than the RA 10^{-6} Construction Worker Scenario.
- Placement of clean fill in areas excavated for the purposes of consolidation to return these areas to original grade.
- Backfill of treated soils on site.
- Restoration of wetland areas, as necessary, which may be disturbed by Site activities.
- Soil cover and or asphalt cap construction in the designated consolidation portions of the trench area as described in Response Measure 2.
- Disposal of work-related residuals (i.e., decontamination waters, PPE, etc.).
- Site cleanup and demobilization.
- Enactment of Institutional Controls.

The implementation of this response measure includes all of the provisions Response Measure 3A. Soils that contain COCs in concentrations in excess of the RA 10^{-6} Construction Worker Scenario would be excavated and treated or disposed of off site. Soils from Areas B, C and the outlying regions of Area A which contain COC concentrations less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria would be excavated and consolidated within the excavated portions of the disposal trench. The trench area would then be contained using a soil cover or an asphalt cap as described in Section 4.1.2. Backfilling and containing soils that exhibit contaminant concentrations less than the 10^{-6} Construction Worker PRGs but greater than the 10^{-6} Commercial Site Worker Criteria would ensure that impact to groundwater standards are not exceeded and groundwater is protected in the event of a breach in the cap.

The final phase of work would consist of restoring wetland areas, as necessary, which may be disturbed by Site activities, final Site clean-up, and fine grading and seeding to mitigate the effects of erosion. Figure 4-2 presents the areas to be excavated and capped, as well as the preliminary approximate locations of the bioremediation cells, staging areas, and clean haul roads that will be constructed.

Operation and maintenance activities to be performed would include periodic inspection of the cover/caps, removal of foreign objects that could damage the cover/caps, maintenance of the vegetative stand, and re-vegetation as necessary. Maintenance of the vegetative cover will include removal of any trees and shrubs to prevent their roots from damaging the subsurface impermeable geomembrane. Maintenance of the asphalt cap would include resealing, repair of cracks, and reapplication of asphalt, as necessary.

This response measure would also involve enactment of institutional controls, including land use restrictions and environmental monitoring. The institutional controls are intended to control human contact with the contaminated media, as a supplement to the response measure. Land use restrictions control exposure to Site contaminants by controlling future Site use through restrictions on property development and prohibition of installation of water supply wells within the property boundaries.

4.1.5 Response Measure 4A: Excavation; Off-Site Low Temperature Thermal Desorption; Off-Site Landfilling/Incineration

This response measure would involve excavation of the Site soils and former disposal trench materials that contain concentrations of the chemicals of concern in excess of the RAOs; off-site disposal of less impacted, non-RCRA hazardous wastes at a permitted Subtitle C or D landfill; off-site low temperature thermal desorption (LTTD) treatment of non-hazardous impacted materials containing less than 1000 ppm of total organic halides, and the incineration of RCRA hazardous wastes (if encountered) at a permitted off-site RCRA incinerator. Following treatment at the LTTD facility, soils would be transported back to the Site for use as backfill. Should the LTTD technology prove to be limited in effectiveness, this response measure also offers the availability of appropriate off-site treatment/disposal options as a contingency measure.

The RAO applicable to this Response Measure will be the RA 10^{-6} Commercial Site Worker Criteria. This RAO is consistent with the applicable ARARs, TBCs, local ordinances, and future Site use scenarios.

This response measure would include the following major elements:

- A pilot-scale treatability study at the selected off-site LTTD facility.
- Design and permitting.
- Selection of treatment and disposal facilities.
- Mobilization of required personnel, facilities, and equipment.
- Site preparation, including inspection and repair of the Site security fence, construction of an equipment and material staging area, decontamination

area, Site clean access road, and implementation of erosion and sedimentation controls.

- Sealing, backfilling, and closing of the Building 5 Trench.
- Excavation of soils exceeding the RAO.
- Segregation/classification of excavated soils, as appropriate, based on treatment/disposal requirements.
- Confirmatory sampling to ensure that soils exceeding the RAO have been excavated.
- Loading and transportation of appropriate soils to off-site treatment/disposal facilities.
- Treatment of appropriate soils at the off-site LTTD facility.
- Transportation of LTTD-treated soils back to the Site for use as backfill.
- Backfill of LTTD-treated soils into the excavated areas, and addition of additional clean fill, as necessary, to return the Site to its original grade.
- Restoration of wetland areas, as necessary, which may be disturbed by Site activities.
- Disposal of work-related residuals (i.e., decontamination waters, PPE, etc.).
- Site cleanup and demobilization

Figure 4-3, found at the end of this document, presents the areas to be excavated as well as the preliminary approximate locations of staging areas and clean haul roads that will be constructed.

Based on conversations with operators of four off-site LTTD treatment facilities located within a reasonable distance of the Site, treatment of pesticide-impacted soil and media using the LTTD technology has successfully been performed on soils from other sites. However, the effectiveness of the technology in treating the range of soil types and media potentially to be encountered at the Pulverizing Services Site would need to be verified through pilot-scale treatability study. The goal of the pilot-scale study would be to determine the general effectiveness of the technology in reducing contaminant concentrations to acceptable levels in Site media and to provide base-level design parameters for full-scale implementation. The pilot-scale study is estimated to require approximately 4 months to complete, resulting in a study duration of approximately 6 months (including data evaluation and report preparation).

Upon completion of successful treatability testing, the appropriate off-site treatment facility would be selected. Permits which may be required include a general stormwater permit (New Jersey Pollutant Discharge Elimination System) and a wetlands disturbance permit.

Prior to initiation of the work, a Site-specific health and safety plan would be prepared. The Site-specific health and safety plan would outline the physical and chemical hazards associated with the work to be performed at the Site and will serve as the instrument of control for ensuring the health and safety of personnel working on the Site. The health and safety plan will also outline the air monitoring program that will be implemented during the construction activities to ensure that a safe working environment is maintained. The health and safety plan will also provide action levels that will dictate the need for implementation of air emissions controls (i.e., dust suppression).

The first phase of the implementation would include mobilization of the required personnel, equipment, and facilities, and site preparation. During the site preparation task, the existing fence would be inspected and repaired as necessary to limit access to the Site during remedial activities to authorized personnel only. A vehicle decontamination pad would be built on site to allow for the decontamination of heavy equipment used on site during construction activities. A staging area would be constructed to provide adequate storage capacity for excavated soil and miscellaneous equipment and supplies.

Following site preparation, impacted soils and media would be excavated, segregated and transported off site to the appropriate treatment/disposal facility. Based on data provided in the Phase I and Phase II Site Investigation Reports, approximately 13,000 tons of material would require excavation and treatment/disposal.

A confirmatory sampling program would be implemented to provide segregation data and quality assurance for the excavation program. Upon completion of excavation, samples would be collected from the walls and base of the excavation and analyzed for pesticides. If analytical results of the confirmatory samples indicate that residual concentrations exceed the RAOs for the chemicals of concern, additional excavation would be performed followed by additional confirmatory sampling. Dust control measures would be required during the excavation activities to reduce the potential for fugitive dust emissions.

The final phase of work would consist of restoring wetland areas, as necessary, which may be disturbed by Site activities, final Site clean-up, and fine grading and seeding to mitigate the effects of erosion.

4.1.6 Response Measure 4B: Excavation; Off-Site Low Temperature Thermal Desorption, Off-Site Landfilling, and Incineration of Soils In Excess of the RA 10^{-6} Construction Worker Scenario, Consolidation and Covering of Remaining On-Site Soils Greater Than The RA 10^{-6} Commercial Site Worker Scenario

This response measure would involve: Excavation of the Site soils and trench materials that contain concentrations of the chemicals of concern in excess of the RA 10^{-6} Construction Worker Criteria RAO; treatment of non-hazardous impacted media containing COCs between 500 and 1,000 ppm of chlorinated compounds at an off-site low temperature thermal desorption (LTTD) treatment unit, off-site disposal of the remaining non-hazardous soils at a permitted Subtitle C or D landfill, incineration of hazardous or listed wastes (if encountered) at a permitted facility, and consolidation of soils from Areas B, C and outlying regions of Area A into the former disposal trench area, and the covering of the backfilled trench area with either a soil or asphalt cap. The soils to be backfilled into the former disposal trench area and covered would contain contaminant concentrations less than the RA 10^{-6} Construction Worker Criteria but greater than the RA 10^{-6} Commercial Site Worker Criteria.

Following treatment of media at the LTTD facility, remediated soils would be transported back to the site to be used as backfill. This response measure also offers the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the treatment process proves to be limited in effectiveness.

This response measure would include the following major elements:

- A pilot-scale treatability test at the selected off-site LTTD facility.
- Design and permitting.
- Selection of treatment and disposal facilities.
- Mobilization of required personnel, facilities, and equipment.
- Site preparation, including inspection and repair of the Site security fence, construction of an equipment and material staging area, decontamination area, Site clean access road, and implementation of erosion and sedimentation controls.
- Sealing, backfilling, and closing of the Building 5 Trench.
- Excavation of soils exceeding the RAO.
- Segregation/classification of excavated soils, as appropriate, based on treatment/disposal requirements.
- Loading and transportation of appropriate soils to off-site treatment/disposal facilities.
- Consolidation of soils containing concentrations less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria within the former trench area.
- Transportation of LTTD-treated soils back to the Site for use as backfill in excavated areas.
- Construction of a soil cover or an asphalt cap (in accordance with the procedures described in Section 4.1.2) over the backfilled trench area.
- Addition of clean fill to return Areas B and C of the Site to its original grade.
- Restoration of wetland areas, as necessary, which may be disturbed by Site activities.
- Disposal of work-related residuals (i.e., decontamination waters, PPE, etc.). Site cleanup and demobilization.
- Enactment of Institutional Controls.

The implementation of this response measure includes all of the provisions of Response Measure 4A. Soils that contain COCs in concentrations in excess of the RA 10^{-6} Construction Worker Scenario would be excavated and treated or disposed of off site. Soils from Areas B, C and the outlying regions of Area A which contain COC concentrations less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria would be excavated and consolidated within the excavated portions of the disposal trench. The trench area would then be contained using a soil cover or an asphalt cap as described in Section 4.1.2. Backfilling and containing soils that exhibit contaminant concentrations less than the 10^{-6} Construction Worker PRGs but greater than the 10^{-6} Commercial Site Worker Criteria would ensure that impact to groundwater standards are not exceeded and groundwater is protected in the event of a breach in the cap. Figure 4-3 presents the areas to be excavated and capped as well as the preliminary approximate locations of staging areas and clean haul roads that will be constructed.

Based on data provided in the Phase I and Phase II Site Investigation Reports, approximately 4,400 tons of material contain concentrations of COCs in exceedance of the RA 10^{-6} Construction Worker Scenario and would require excavation and remediation. Approximately 8,600 tons of soils which contain COC concentrations less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria would be excavated, consolidated within the disposal trench area, and covered with a soil cover or asphalt cap.

After remedial and capping activities have been completed, any wetland areas which may be disturbed by Site activities would be restored and institutional controls would be enacted to preserve the integrity of the soil cover or caps. Should the effectiveness of the treatment technology element of this Response Measure prove to be limited, this response measure also offers the availability of appropriate off-site treatment/disposal options as a contingency measure.

4.1.7 Response Measure 5A: Excavation; Off-Site Incineration; Off-Site Landfilling

This response measure would involve excavation of the Site soils and trench materials that contain concentrations of the chemicals of concern in excess of the RA 10^{-6} Commercial Site Worker Criteria; off-site disposal of non-hazardous soils containing COC concentrations that are appropriate for land disposal at a permitted RCRA Subtitle C or D landfill; incineration of remaining media and RCRA-listed wastes (if encountered) at a permitted off-site facility.

This response measure would include the following major elements:

- Design and permitting.
- Selection of treatment and disposal facilities.
- Mobilization of required personnel, facilities, and equipment.
- Site preparation, including inspection and repair of the Site security fence, construction of an equipment and material staging area, decontamination

area, Site clean access road, and implementation of erosion and sedimentation controls.

- Sealing, backfilling, and closing of the Building 5 Trench.
- Excavation of soils exceeding the RAO.
- Segregation/classification of excavated soils, as appropriate, based on treatment/disposal requirements.
- Loading and transportation of appropriate soils to off-site treatment/disposal Facilities.
- Backfill of the excavated areas using clean fill to return the Site to its original grade.
- Restoration of wetland areas, as necessary, which may be disturbed by Site activities.
- Disposal of work-related residuals (i.e., decontamination waters, PPE, etc.).
- Site cleanup and demobilization.

Figure 4-4, found at the end of this document, presents the areas to be excavated as well as the preliminary approximate locations of staging areas and clean haul roads that will be constructed.

The first phase of the project would be design and permitting. Permits which may be required include a general stormwater permit (New Jersey Pollutant Discharge Elimination System), and a wetlands disturbance permit.

Prior to initiation of the work, a Site-specific health and safety plan would be prepared. The Site-specific health and safety plan would outline the physical and chemical hazards associated with the work to be performed at the Site and will serve as the instrument of control for ensuring the health and safety of personnel working on the Site. The health and safety plan will also outline the air monitoring program that will be implemented during the construction activities to ensure that a safe working environment is maintained. The health and safety plan will also provide action levels that will dictate the need for implementation of air emissions controls (i.e., dust suppression).

The first phase of the implementation would include mobilization of the required personnel, equipment, and facilities, and Site preparation. During the Site preparation task, the existing fence would be inspected and repaired as necessary to limit access to the Site during remedial activities to authorized personnel only. A vehicle decontamination pad would be built on Site to allow for the decontamination of heavy equipment used on Site during construction activities. A staging area would be constructed to provide adequate storage capacity for excavated soil and miscellaneous equipment and supplies.

Following Site preparation, soils and media exceeding the RAOs will be excavated, segregated, and disposed/treated off site, as appropriate. Based on data provided in the Phase I and Phase II Site Investigation Reports, approximately 13,000 tons of material would require excavation and treatment/disposal.

A confirmatory sampling program would be implemented to provide segregation data and quality assurance for the excavation program. Upon completion of excavation, samples would be collected from the walls and base of the excavation and analyzed for pesticides. If analytical results of the confirmatory samples indicate residual concentrations exceed the RAOs for the chemicals of concern, additional excavation would be performed followed by additional confirmatory sampling. Dust control measures would be required during the excavation activities to reduce the potential for release of contaminated particulate matter.

The final phase of work would consist of restoring any wetland areas, as necessary, which may be disturbed by Site activities, final Site clean-up, and fine grading and seeding to mitigate the effects of erosion.

4.1.8 Response Measure 5B: Excavation; Off-Site Incineration, and Off-Site Landfilling of Soils In Excess of the RA 10^{-6} Construction Worker Scenario; and Consolidation and Covering of Remaining On-Site Soils Greater Than the RA 10^{-6} Commercial Site Worker Criteria

This response measure would involve excavation of the Site soils and trench materials that contain concentrations of the chemicals of concern in excess of the RA 10^{-6} Construction Worker Scenario; off-site disposal of non-hazardous wastes containing COC concentrations that are appropriate for land disposal at a permitted Subtitle C or D landfill; incineration of remaining media and RCRA-hazardous wastes (if encountered) at a permitted facility; and consolidation of soils from Areas B, C and outlying regions of Area A into the former disposal trench area, and the covering of the backfilled trench area with either a soil cover or asphalt cap. The soils to be backfilled into the former disposal trench area and covered would contain contaminant concentrations less than the RA 10^{-6} Construction Worker Criteria but greater than the RA 10^{-6} Commercial Site Worker Criteria.

This response measure would include the following major elements:

- Design and permitting.
- Selection of off-site treatment and disposal facilities.
- Mobilization of required personnel, facilities, and equipment.
- Site preparation, including inspection and repair of the Site security fence, construction of an equipment and material staging area, decontamination area, Site clean access road, and implementation of erosion and sedimentation controls.
- Sealing, backfilling, and closing of the Building 5 Trench.
- Excavation of soils exceeding the RAOs.

- Confirmatory sampling to ensure that soils exceeding the RAOs have been excavated for treatment/disposal.
- Segregation/classification of excavated soils, as appropriate, based on treatment/disposal requirements.
- Loading and transportation of appropriate soils to off-site treatment/disposal facilities.
- Treatment of media at permitted RCRA incinerator.
- Excavation and consolidation of soils containing COC concentrations less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria within the former disposal trench area.
- Constructing a soil cover or an asphalt cap (following the procedures described in Section 4.1.2) over the backfilled trench area
- Addition of clean fill as necessary to return Areas B and C of the Site to original grade.
- Restoration of wetland areas, as necessary, which may be disturbed by Site activities.
- Disposal of work-related residuals (i.e., decontamination waters, PPE, etc.).
- Site cleanup and demobilization.
- Enactment of Institutional Controls.

The implementation of this response measure includes all of the provisions stated in Remedial Response Measure 5A. Soils that contain COCs in concentrations in excess of the RA 10^{-6} Construction Worker Scenario would be excavated and treated or disposed of off site. Soils from Areas B, C and the outlying regions of Area A which contain concentrations of COCs that are less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria would be excavated and placed in the excavated portions of the former disposal trench. The materials placed within the former disposal trench area would then be contained using a soil cover or an asphalt cap as described in Section 4.1.2. Backfilling and containing soils that exhibit contaminant concentrations less than the 10^{-6} Construction Worker PRGs but greater than the 10^{-6} Commercial Site Worker Criteria would ensure that impact to groundwater standards are not exceeded and groundwater is protected in the event of a breach in the cap. Figure 4-4 presents the areas to be excavated and capped as well as the preliminary approximate locations of staging areas and clean haul roads that will be constructed.

Based on data provided in the Phase I and Phase II Site Investigation Reports, approximately 4,400 tons of material are in exceedance of the RA 10^{-6} Construction Worker Scenario and would require excavation and remediation. Approximately 8,600 tons of soils which contain COCs less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria would be contained within the excavated trench using a soil cover or asphalt cap.

After remedial and capping activities have been completed, institutional controls would be enacted to preserve the integrity of the soil cover or asphalt cap, disturbed wetland areas would be restored, and Operation and Maintenance activities would be implemented.

4.2 DETAILED EVALUATION CRITERIA

Each of the response measures are examined with respect to nine evaluation criteria as required by the NCP [40 CFR 300.430(e)(9)(iii)]. The first two criteria relate to statutory requirements and are therefore categorized as "threshold criteria" that must be met by each response measure. These two criteria are:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs

Five additional criteria are grouped together as the primary balancing criteria upon which the selection of response measures is based. Each response measure's overall performance capabilities are "balanced" against each other to determine the response measure that most cost-effectively satisfies the threshold criteria. These criteria are:

- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume Through Treatment
- Short-term Effectiveness
- Implementability
- Cost

The final criteria are modifying criteria and are applied following the public comment period to evaluate government and community acceptance. These criteria are classified as "modifying" because although they may not dictate the selection of the response measure, they will impact the details associated with the implementation of the selected response measure. These criteria are:

- Government Acceptance
- Community Acceptance

Each of the nine evaluation criteria are assessed by evaluating specific factors to allow a thorough and consistent analysis of the response measures.

<u>Overall Protection of Human Health and the Environment</u>: This evaluation criterion provides an assessment of overall protection based on a combination of factors including long-term and short-term effectiveness and compliance with ARARs. This criterion is considered a threshold criterion that a response measure must meet to be considered for selection. To meet the requirements of this criterion, a response measure must reduce Site-specific risks to an acceptable level and satisfy the goal set by the remedial action objectives. Evaluations of the overall protectiveness address:

- How well a response measure achieves protection over time.
- How significantly the Site risks are reduced.
- How each contaminant source is to be eliminated, reduced, or controlled.

Compliance with ARARs: This evaluation criterion is used to determine how each response measure complies with applicable or relevant and appropriate Federal, State, and local requirements. Each response measure is evaluated in detail to determine compliance with chemical-specific, action-specific, and location-specific ARARs, as well as with other criteria, advisories, and guidance ("To Be Considered" material).

Long-Term Effectiveness: This evaluation criterion addresses the results of the response measure in terms of the risk remaining after the remedial action objectives have been met, particularly the effectiveness of the controls that will be applied to manage the risks posed by the residuals of the treatment process and/or untreated wastes. The components of this criterion include the magnitude of the remaining risks measured by numerical standards such as cancer risk levels; the adequacy and suitability of controls used to manage treatment residuals or untreated wastes; and the long-term reliability of management controls for providing continued protection from residuals (i.e., the assessment of potential failure of the technical components).

Reduction of Toxicity, Mobility or Volume Through Treatment: This evaluation criterion addresses the statutory preference that treatment be used to reduce the principal threats of the total mass of toxic contaminants, irreversibly reduce contaminant mobility, or reduce the total volume of contaminated media [40 CFR 300.430(f)(1)(ii)(E)]. Factors to be evaluated include the treatment process employed; the amount of hazardous material destroyed or treated; the degree of reduction in toxicity, mobility, or volume expected; and the type and quantity of residuals generated by the treatment process.

Short-Term Effectiveness: This evaluation criterion addresses the impacts of the action during the construction and implementation phase until the remedial response objectives are met. Factors to be evaluated include protection of workers during the remedial action, environmental impacts resulting from implementation of the remedial action, and the time required to achieve the remedial action objectives.

Implementability: This criterion addresses the technical and administrative feasibility of implementing a remedial response measure and the availability of various services and materials required for its implementation. Factors of technical feasibility include construction and operation difficulties, reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy. The administrative feasibility includes the time required for permit approval, property access, and for activities needed to coordinate with applicable State and local agencies. Factors to evaluate the availability of services and materials include availability of treatment, storage, and disposal services with required capacities; availability of equipment and specialists; and availability of prospective technologies for competitive bid.

Cost: The types of costs that are addressed include: capital costs, operation and maintenance (O&M) costs, costs of five-year reviews (where applicable), and present value of O&M costs. Capital costs consist of both direct and indirect costs. Direct costs

400091

include expenditures for the equipment, labor, and materials necessary to perform the remedial action. Indirect costs include expenditures for engineering, financial, and other services required to complete the implementation of the remedial response measure. The following four indirect costs are generally included in the cost analysis:

- Engineering and Design: Engineering and design costs include design and process development, preparation of specifications and bid documents, drafting, and additional monitoring and testing that may be required.
- Permitting and Legal: Expenses may include legal fees and fees for technical support necessary to obtain licenses and permits. This estimate covers the cost for preparing permit applications and obtaining permits, as well as the cost of obtaining legal advice for negotiating construction and operating contracts.
- Services During Construction: This item is intended to cover the anticipated costs incurred during the actual implementation of the remedial response measure. It includes construction management, submittal review and office support services, and the production of required O&M manuals.
- Health and Safety: This estimate is intended to reflect the additional costs that will be incurred due to the health and safety program that will be required. Costs cover medical monitoring of on-Site workers, health and safety equipment and monitoring devices, oversight by trained health and safety officers, as well as perimeter monitoring to guard against potential off-site releases during response measure implementation.

Annual O&M costs include auxiliary materials and energy, disposal of residues, administrative fees, rehabilitation costs, and costs for periodic Site reviews.

There are two contingency factors that are applied to the cost estimates; scope and bid. These contingencies represent uncertainties involved in the project costing and are intended to cover the additional costs that may be required to complete the project. These contingency factors are discussed below:

- Scope Contingencies: Cover changes in the scope-of-work that may occur during final design and implementation. The scope contingency provides a reserve for change orders, unanticipated increases in unit quantities and volumes, and adjustments to technologies that may be necessary to meet the Site-specific remedial action objectives. Scope contingencies may range from 10 to 60% based on the confidence placed on the estimated quantities and associated unit costs.
- Bid: Bid contingencies may cover unknown costs associated with construction, such as adverse weather conditions, strikes by material suppliers, unfavorable market conditions, and other unknowns. Bid contingencies are applied on the construction subtotal and typically range from 10 to 20%.

- Government and Community Acceptance: These criteria evaluate the technical and administrative issues and concerns that government agencies and the public may have regarding each of the response measures. Government and community comment will be solicited following issuance of the Draft RME Report, through a formal review and comment process. Government concerns will be addressed in the Final RME Report. Community acceptance issues will be addressed during development of the remedial action plan.

4.3 DETAILED EVALUATION OF RESPONSE MEASURES

This section provides a detailed evaluation of each of the response measures with respect to the evaluation criteria. Table 4-1 presents a summary of the detailed evaluation of the response measures.

4.3.1 Response Measure 1: No Action

The No-Action Response Measure is used as the basis of comparison with other response measures. The purpose of the No-Action Response Measure is to serve as a baseline for defining the current risks posed by the Site and for evaluating the risk mitigation capabilities of other response measures. There are no technologies or remedial activities associated with the No-Action Response Measure since, as the title implies, no additional activities would be performed at the Site. However, several activities have already occurred at the Site which have served to reduce the potential for exposure to Site contaminants. Primarily, a Site security fence was installed between 1987 and 1993 to control access onto the Site). In addition, administrative institutional controls have already been enacted at the Site in the form of zoning restriction (the Site is currently zoned "Specially Restricted Industrial").

4.3.1.1 Overall Protection of Human Health and the Environment

The No-Action Response Measure does not include any additional activities which would serve to reduce any of the potential risks associated with the Site. However, the potential risks are currently controlled by the presence of a security fence present around the perimeter of the property.

4.3.1.2 Compliance With ARARs

The chemical-specific and location-specific ARARs for soil would not be met through this response measure. Action-specific ARARs do not apply to this response measure.

4.3.1.3 Long-Term Effectiveness

The No-Action Response Measure does not reduce the Site risks since contaminated soil would remain exposed for potential contact and/or ingestion.

4.3.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The No-Action Response Measure does not actively reduce the mobility, toxicity, or volume of the contaminants at the Site. However, some reduction in the toxicity of the contaminants will likely be realized over time due to natural attenuation, flushing, dilution, and other naturally occurring processes.

4.3.1.5 Short-Term Effectiveness

The No Action Response Measure would not result in increased short-term risks nor would it reduce the potential Site risks in the short-term.

4.3.1.6 Implementability

Since the No Action Response Measure does not include any additional activities, it has effectively already been implemented.

4.3.1.7 Cost

There are no costs associated with the No Action Response Measure.

4.3.2 Response Measure 2: Selective Excavation, Consolidation, and Capping

Capping or placement of a soil cover is a form of containment technology that serves as a barrier to reduce the potential for exposure to the impacted media at the Site. The cap/soil cover also reduces the mobility of contaminants by prohibiting infiltration of stormwater runoff and thereby limiting subsequent leaching of contaminants into the underlying soils and groundwater. Evaluation of this response measure with respect to each of detailed evaluation criteria is presented below.

4.3.2.1 Overall Protection of Human Health and the Environment

By eliminating the possibility of direct contact, inhalation, and ingestion of the contaminated soil, this response measure will substantially reduce the human health risks associated with the Site. The cover/cap will also prevent the migration of Site contaminants via erosion and wind dispersion since the contaminants will be contained beneath a minimum of two feet of soil that will be vegetated to limit the effects of erosion. The cover/cap will also minimize the infiltration of stormwater runoff into the Site soils and will therefore minimize the leaching of soil contaminants into the subsurface soils and groundwater. Through proper construction and maintenance, the soil cover with impermeable geomembrane, asphalt caps, and RCRA caps would be protective of human health and the environment, indefinitely. Should wetland areas be disturbed by Site activities, they would be restored and protected in accordance with federal or state requirements.

Table 4-1
Pulverizing Services Site
Summary of Detailed Evaluation of Response Measures

...nce With ARARs	Long Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost
...l-specific and ...c ARARs would ...h this ... do not ...asure.	• PRG's derived for protection of human health and the environment would not be met, since Site impacted soils and media would remain on-site. However, a security fence and current zoning are effective in protecting human health	• This response measure does not reduce the mobility, toxicity, or volume of contaminant present in soil/trench materials at the Site.	• This response measure does not result in increased short-term risks nor would it reduce the potential Site risks	This response measure has effectively already been implemented	• There are no costs associated with the No-Action response measure.
	Significantly reduces the long-term risks associated with Site soil/trench material by eliminating direct contact exposure pathways and mitigating contaminant migration. Permanent reduction of risks could be accomplished through proper construction, appropriate and extended maintenance of the cover, and proper enforcement of institutional controls	• This response measure does not include active treatment to reduce toxicity contamination, although some degradation will occur over time. • Mobility of pesticides in surficial soil/trench materials is reduced through containment.	• This response measure can be implemented quickly to reduce the potential Site risks. • Short-term risks resulting from implementation of this response measure would be low. Although construction would require limited handling of contaminated soils and dust generation, the risks could be controlled through the use of suitable protective equipment, good construction practice, and standard dust suppression techniques	• Weather permitting, this response measure could be implemented in less than one year, as the materials, equipment and services necessary for implementation are readily available.	The total present worth-cost for this response measure is approximately $1,751,670, including a capital cost of $1,339,063.

Table 4-1
Pulverizing Services Site
Summary of Detailed Evaluation of Response Measures

Response Measure Description	Overall Protection of Human Health & the Environment	Compliance With ARARs	Long Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost
Response Measure 3A: Excavation, On-site Anaerobic Bioremediation and Off-site Landfilling/ Incineration	• The overall effectiveness of this response measure is dependent on the success and implementability of the bioremediation process and cannot be determined at this time. Extensive treatability testing would be required to determine if the bioremediation technology can be completely effective treating the Site soils/media to below the RAOs. • The landfilling and incineration component of this Response Measure have been proven effctive in protecting human health and the environment.	• Ability of bioremediation element to meet the chemical-specific ARARs is uncertain and would need to be verified through extensive treatability studies. • Compliance with action-specific ARARs would be required during construction. • Wetland ARARs would be considered for areas adjacent to or within wetlands. • Compliance with location-specific ARARs, including New Jersey stormwater-related ARARs, would be required and considered during the remedial design.	• The level of effectiveness of the bioremediation process in treating Site soils is uncertain and would need to be determined through extensive treatability studies. • If successful, bioremediation of the soils would be a permanent remedy because the toxicity of the Site contaminants would be reduced. • The remaining components of this Response Measure are protective of human health and the environment.	• The bioremediation treatment process should be effective in reducing the toxicity of Site contaminants. However, the ability of the technology to treat the site media to concentrations below the PRGs is uncertain. • The incineration comoponent of this Response Measure will reduce the toxicity, mobility and volume through treatment. • Landfilling will reduce the mobility and the toxicity of the impacted soils.	• Short-term risks resulting from implementation include significant contaminated material handling and dust generation, as well as inhalation of off-gases generated during the on-site treatment of soils. • Although appropriate measures would be taken to control these risks during implementation, the potential would remain for failure of the off-gas collection and treatment system and subsequent exposure of nearby residents and workers at the neighboring food processing facility.	• The implementability of the bioremediation technology is uncertain and would need to be determined through extensive treatability studies, requiring approximately one year to complete. • The actual time required for complete treatment of Site soils (assuming successful treatability studies) is estimated to be several years. • The remaining component of this Response Measure can be readily implemented.	The total present-worth cost for this remedial response is approximately $3,502,213-$5,905,217 including a capital cost ranging from $3,023,694 to $5,113,263

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400096

Table 4-1
Pulverizing Services Site
Summary of Detailed Evaluation of Response Measures

Response Measure Description	Overall Protection of Human Health & the Environment	Compliance With ARARs	Long Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost
Response Measure 3B: Excavation, On-site Anaerobic Bioremediation; Off-site Landfilling/Incineration and Capping	Response Measure 3B includes all of the treatment and disposal elements of Response Measure 3A. Therefore, the comments corresponding to each of the detailed evaluation criteria for Response Measure 3A also apply to this Response Measure, as well as the comments from Response Measure 2 related to capping.						The total present-worth cost for this remedial response is approximately $3,047,416-$5,388,290 including a capital cost ranging from $2,413,875 to $4,177,075
Response Measure 4A: Excavation; Off-site Low Temperature Thermal Description; Off-Site Landfilling/Incineration	• A pilot-scale treatability study needed to ensure the complete effectiveness of the LTTD technology in treating the range of soil types and media which may potentially be encountered. • Based on bench scale study results, off-site LTTD could reduce the concentrations of the COCs in the treated soils and media to acceptable levels and could thereby prevent degradation of the groundwater and subsurface soils. • Excavation and landfill/incineration would be protective of human health and the environment through removal of COCs from the Site and off-site secure disposal or destruction.	• Off-site LTTD process could likely treat the Site soils to meet the chemical-specific ARARs. Removal and off-site treatment/disposal would also meet chemical-specific ARARs. • Compliance with location-specific and action-specific ARARs would be required and considered during the design and implementation phases, respectively. • Wetland ARARs would be considered for areas adjacent to or within wetlands.	• Over the long-term, LTTD treatment of site media would effectively reduce the risks associated with exposure because the toxicity of the contaminants would be reduced through the LTTD process. Treatment would also be a permanent option. • The remaining components of this response measure, removal and off-site disposal, are permanent remedies with an acceptable level of long-term effectiveness	• Based on bench-scale treatability study results, off-site LTTD could be effective in reducing the toxicity of the soils and impacted media to meet the RAOs. However, a pilot-scale treatability study would be needed to ensure the effectiveness on a fully operational scale in treating the range of soil types and media which potentially could be encountered. • Excavation of site media would result in reduction of mobility, as would disposal in a Subtitle C or D landfill. • Treatment through off-site incineration would reduce the toxicity of any hazardous wastes, if encountered.	• The effectiveness of the off-site LTTD process must be verified through pilot-scale treatability study, which would delay implementation of the remedy in the short-term. • Off-site disposal elements of this response measure could be performed quickly to result in a short-term reduction of Site risk. • Construction activities, would result in significant material handling and dust generation, but potential for exposure could be eliminated through the use of suitable protective clothing and equipment, good construction practice, and standard dust suppression techniques.	• Implementability is primarily dependent on the availability of a permitted, operational off-site LTTD facility • The remaining elements of this response measure, excavation and off-site treatment and disposal, are proven technologies and are readily implementable	The total present-worth cost for this remedial response is approximately $3,039,223-$5,406,174 Capital costs range form $2,621,094-$4,679,313

400097

Table 4-1
Pulverizing Services Site
Summary of Detailed Evaluation of Response Measures

Response Measure Description	Overall Protection of Human Health & the Environment	Compliance With ARARs	Long Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost
Response Measure 4B: Excavation; Off-site Low Temperature Thermal Desorption, Off-Site Landfilling, and Incineration of Soils in Excess of the RA 10^{-6} Construction Worker Scenario. Consolidation and Covering of Remaining On-Site Soils Greater Tan RA 10^{-6} Site Worker Scenario.	Response Measure 4B includes all of the treatment and disposal elements of Response Measure 4A. Therefore, the comments corresponding to each of the detailed evaluation criteria for Response Measure 4A also apply to this Response Measure, as well as the comments from response measure 2 related to capping.						The total present-worth cost for this remedial response is approximately $2,744,281-$4,991,775 Capital costs range form $2,148,188-$3,830,188
Response Measure 5A: Excavation; Off-site Incineration; Off-Site Landfilling	• Provides an acceptable level of protection of human health and the environment through removal of COCs and off-site secure disposal or thermal destruction. • Prevents degradation of groundwater and soils an eliminates the potential for direct contact with COCs.	• Removal and off-site treatment and disposal would meet the chemical-specific ARARs. • Compliance with location-specific and Action-Specific ARARs would be required and considered during the design and implementation phases, respectively. • Wetland ARARs would be considered for areas adjacent to or within wetlands.	• Removal and off-site incineration is a permanent remedy • Reduces the risks associated with exposure to the contaminated soils as toxicity of COCs is reduced through incineration.	• Excavation would result in reduction of mobility, as would disposal of media in a Subtitle C or D landfill. • Off-site incineration would reduce the toxicity of contaminated media which could not be landfilled.	• This response measure could be implemented quickly to reduce short-term site risks. • Although construction activities would result in significant material handling and dust generation, the potential for exposure could be reduced through the use of suitable protective clothing and equipment, good construction practice, and standard dust suppression techniques.	• This response measure is both technically and administratively feasible to construct. • The required construction materials, services, and equipment are readily available. • Engineering considerations associated are design and construction of stormwater a d sedimentation controls.	The total present-worth cost for this remedial response is approximately $3,258,190-$6,064,046 Capital costs range form $2,811,500-$5,251,375
Response Measure 5B: Excavation; Off-site Incineration, and Off-Site Landfilling of Soils in Excess of the RA 10^{-6} Construction Worker Scenario; and Consolidation and Covering of Remaining On-Site Soils Greater Than the RA 10^{-6} Site Worker Criteria	Response Measure 5B includes all of the treatment and disposal elements of Response Measure 5A. Therefore, the comments corresponding to each of the detailed evaluation criteria for Response Measure 5A also apply to this Response Measure, as well as the comments from response measure 2 related to capping.						The total present-worth cost for this remedial response is approximately $3,510,538-$5,395,388 Capital costs range form $2,536,438-$4,175,438

4.3.2.2 Compliance with ARARs

The purpose of the risk-based PRGs is to prevent unacceptable exposure of receptors to contaminated media. This response measure meets the intent of the chemical-specific ARARs by preventing direct contact with the contaminants and mitigating residual contaminant migration. Should wetland areas be disturbed during the course of Site activities, their restoration will be performed in accordance with federal or state location-specific ARARs. Compliance with other location-specific ARARs would be required and considered during the design phase. Compliance with action-specific ARARs would be required during implementation of the response measure and would also therefore be considered during the remedial design.

4.3.2.3 Long-Term Effectiveness and Permanence

Covering/capping contaminated soils and disposal trench materials eliminates the long-term risks associated with direct contact, inhalation and ingestion of contaminated media by providing a barrier between the contaminated media and receptors. Covering/capping also mitigates the residual leaching of contaminants into the groundwater by minimizing infiltration of stormwater runoff.

The permanence of this response measure is dependent on the design life of the cover/cap, assuming normal conditions of wear and tear. Periodic inspection and maintenance, including re-vegetation and sealing of cracks in asphalt, would be required to mitigate the effects of erosion/weathering and preserve the integrity of the soil cover and caps. Although this response measure does not provide for active treatment, it would achieve the remedial action objectives and reduce Site risks. Institutional controls to be implemented as part of this response measure would also aid in managing future risks associated with the Site. Permanent reduction of risks could be accomplished through the proper and extended maintenance of the soil cover and RCRA and asphalt caps.

4.3.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The low mobility of the Site constituents is further reduced by this response measure because the soil cover with impermeable geomembrane, asphalt cap and RCRA cap eliminate infiltration of stormwater into the Site soils and mitigates the potential for leaching of the contaminants into the underlying soils and groundwater. Capping/covering also reduces the mobility of the contaminants by preventing migration via wind dispersion of contaminated particulates, as well as transport of the contaminants via erosion. This response measure does not employ treatment to reduce the toxicity or volume of the contaminants. Although it is anticipated that the toxicity of the contaminants would be reduced over time through natural processes such as attenuation and biodegradation, the overall effectiveness of such natural processes cannot be predicted at this time.

4.3.2.5 *Short-Term Effectiveness*

This response measure can be implemented quickly to reduce the current Site risks in the short term. Construction activities, including clearing and grubbing, grading, and excavation and consolidation of selected Site soils could result in limited handling of contaminated soils and dust generation. However, the potential for exposure can be reduced through the use of suitable protective clothing, air monitoring equipment, good construction practices, and standard dust suppression techniques. Therefore, short-term risks to the community, workers, or the environment as a result of implementation of this response measure are expected to be low. Air monitoring would be performed during the construction activities to ensure that a safe working environment is maintained and that no threat to public health or the environment is created by fugitive dust emissions.

4.3.2.6 *Implementability*

The soil cover with impermeable geomembrane, asphalt cap, and RCRA cap are technically feasible to construct. Minor clearing, grubbing, and grading will be necessary to prepare the area for construction. The required construction materials, services, and equipment that would be utilized to construct the soil cover, asphalt cap, and RCRA cap are readily available. The time required for actual construction is estimated to be less than one year to construct, weather permitting. Wetlands restoration, if required, is technically and administratively feasible and is a proven and accepted technique for rehabilitating disturbed wetland areas.

The major engineering considerations associated with this response measure include design and construction to minimize settlement and erosion, design of stormwater and sedimentation controls, anticipated design-life of the cover caps, and effects of environmental factors such as temperature extremes, rainfall, and wind on the cover/ caps. Approximately six months would be required for design, contractor procurement, and permitting, resulting in an complete implementation schedule of approximately eleven months.

4.3.2.7 *Cost*

The estimated capital cost for construction of the soil cover with impermeable geomembrane, asphalt cap, and RCRA cap over the hazardous wastes and soils containing concentrations of the chemicals of concern in excess of the RA 10^{-6} Construction Worker Scenario is approximately 1.75 million dollars. This cost estimate assumes that implementation of this response measure would occur over an approximate one-year period.

O&M costs include periodic maintenance, including mowing over a 30 year period at a 5% rate of interest. O&M costs also include quarterly groundwater sampling for two years. The total cost of this response measure including O&M is estimated to be 1.86 million dollars. A summary of the cost estimate is provided in Appendix A.

4.3.3 Response Measure 3A: Excavation; On-Site, Ex-situ Anaerobic Biotreatment; Off- Site Landfilling/Incineration

This response measure involves the use of a treatment and disposal technologies to reduce the toxicity of contaminants on site. Reduction in toxicity would be achieved through anaerobic bioremediation, off-site landfilling, and incineration of Site soils and media containing contaminants of concern at concentrations in excess of the RAOs.

Analysis of this response measure with respect to each of the detailed evaluation criteria is presented below.

4.3.3.1 Overall Protection of Human Health and the Environment

The effectiveness of the anaerobic bioremediation process in achieving the remedial action objectives and the overall level of effectiveness in protecting human health and the environment is uncertain at this time and would need to be verified through extensive bench- and on-site pilot-scale treatability studies. However, as discussed during the technology screening analysis, bioremediation has been demonstrated to be successful in degrading chlorinated pesticides at other sites, including the Stauffer Management Company Site in Tampa, Florida. If successful, bioremediation would reduce the concentrations of the contaminants in the treated soils and media to acceptable levels and would also prevent further degradation of the groundwater and subsurface soils. This response measure also offers the availability of an appropriate off-site treatment/disposal facility as a contingency if the effectiveness of the bioremediation treatment process proves to be limited.

Excavation and landfilling/incineration will provide an acceptable level of protection of human health and the environment through removal of chemicals of concern from the site and off-site secure disposal or destruction. Should wetland areas be disturbed by Site activities, they would be restored and protected by this Response Measure.

4.3.3.2 Compliance with ARARs

The effectiveness of the bioremediation process in complying with the chemical-specific ARARs is uncertain at this time and would need to be verified through performance of extensive bench- and pilot-scale treatability studies. Removal and off-site treatment and disposal would allow for compliance with chemical-specific ARARs. Should wetland areas be disturbed during the course of Site activities, their restoration will be performed in accordance with federal or state location-specific ARARs. Compliance with other location-specific ARARs would be required and considered during the design phase. Compliance with action-specific ARARs would be required during implementation of the response measure and would also therefore be considered during the remedial design.

4.3.3.3 *Long-Term Effectiveness and Permanence*

To the extent that bioremediation treatment process is successful, excavation and treatment of contaminated soils would greatly reduce the long-term risks associated with exposure to the contaminated soils because the toxicity of the contaminants would be reduced through the biological treatment process. The anaerobic bioremediation of the soils would also be a permanent remedy if the treatment process were effective. However, this response measure also offers the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the treatment process proves to be limited. Therefore, the long-term effectiveness and permanence of this aspect of the response measure cannot be definitively evaluated at this time. However, the remaining components of the response measure, removal and off-site disposal, are permanent remedies with an acceptable level of long-term effectiveness.

4.3.3.4 *Reduction of Toxicity, Mobility, or Volume Through Treatment*

The effectiveness of the bioremediation process in reducing the toxicity of the soils and impacted media at the Pulverizing Services Site to meet the RAOs is uncertain at this time and would need to be verified through performance of extensive bench- and pilot-scale treatability studies. However, as discussed during the technology screening analysis, bioremediation has been demonstrated to be successful in degrading chlorinated pesticides at other sites, including the Stauffer Management Company Site in Tampa, Florida. Should the effectiveness of the technology prove to be limited, this response measure offers an appropriate off-site treatment/disposal facility as a contingency measure.

Excavation of site media would result in reduction of mobility, as would disposal in a Subtitle C or D landfill. Treatment through off-site incineration would reduce the toxicity of any listed wastes which could not be bio-remediated.

4.3.3.5 *Short-Term Effectiveness*

Due to the uncertainty of the effectiveness of the bioremediation treatment process and the extensive bench- and pilot-scale treatability studies that would be required, this response measure could take up to several years to completely implement. The off-site treatment and disposal elements of this response measure could be implemented quickly and would result in a short-term reduction of site risk.

Construction activities, including excavation and staging of contaminated soils would result in significant material handling and dust generation. However, exposure could be reduced through the use of suitable protective clothing, equipment, good construction practice, and standard dust suppression techniques. Air monitoring would be required during the construction activities to ensure that a safe working environment is maintained and that no threat to public health or the environment is created by air emissions.

Other short-term risks associated with this response measure include inhalation of off-gases generated as a result of the on-site soil treatment. These risks would be considered during the design phase and appropriate measures would be taken to collect and treat the off-gases.

4.3.3.6 Implementability

The effectiveness of the bioremediation treatment process in reducing the COC concentrations in the Site soils to meet the RAOs is uncertain. The treatment process is highly dependent on Site-specific conditions such as soil type, nutrient availability, and the presence of oxygen. Therefore, extensive bench- and on-site pilot-scale treatability testing would be required to determine if anaerobic bioremediation could be effective in treating the Site soils to meet the RAOs. The bench- and pilot-scale treatability studies are estimated to require approximately five months each to complete, resulting in a study period of approximately one year. The actual time required for full-scale treatment to meet the remedial action objectives cannot be determined without first performing bench- and pilot-scale treatability studies. However, based on preliminary data from application of this technology at other Sites, it is estimated that the treatment would require one to two years for completion, resulting in a total implementation timeframe of approximately three years.

Wetlands restoration, if required, is technically and administratively feasible and is a proven and accepted technique for rehabilitating disturbed wetland areas. The restoration of wetlands disturbed by Site activities would be delayed as soils to be used for backfilling and restoring the wetland areas undergo the biotreatment process.

The remaining elements of this response measure, excavation and off-site treatment and disposal, are proven technologies which can be readily implemented.

4.3.3.7 Cost

The estimated capital cost for this response measure ranges from 3.02 to 5.11 million dollars based on the excavation, placement, treatment, and backfilling of approximately 13,000 tons of soil and trench material. This cost estimate assumes that the biological treatment would cost approximately $75 per ton, plus costs associated with treatability studies and material handling. The total cost of this response measure ranges from 3.50 to 5.91 million dollars. As noted in the summary of the cost estimate which is provided in Appendix A, the mobilization and treatability study costs associated with this response measure are substantial.

4.3.4 Response Measure 3B: Excavation; On-Site, Ex-situ Anaerobic Biotreatment; Off-Site Landfilling/Incineration and Capping

This response measure involves the use of treatment and disposal technologies to reduce the toxicity of contaminants to be removed from the Site, and a containment technology to reduce the mobility of contaminants remaining on site. Reduction in toxicity would be achieved through anaerobic bioremediation, off-site landfilling, and incineration of Site soils and media containing contaminants of concern at concentrations in excess of the RAOs. Consolidation and capping of impacted soils from other areas of the Site within the disposal trench area would add another level of protectiveness to this response measure. This response measure also offers the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the bioremediation treatment process proves to be limited.

Analysis of this response measure with respect to each of the detailed evaluation criteria is presented below.

4.3.4.1 Overall Protection of Human Health and the Environment

The effectiveness of the anaerobic bioremediation process in achieving the remedial action objectives and the overall level of success in protecting human health and the environment is uncertain at this time and would need to be verified through extensive bench- and on-Site pilot-scale treatability studies. However, as discussed during the technology screening analysis, bioremediation has been demonstrated to be successful in degrading chlorinated pesticides at other sites, including the Stauffer Management Company Site in Tampa, Florida. If successful, bioremediation would reduce the concentrations of the contaminants in the treated soils and media to acceptable levels and would also prevent potential further degradation of the groundwater and subsurface soils. This response measure also offers the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the bioremediation treatment process proves to be limited.

Excavation and consolidation, and landfilling/incineration will provide an acceptable level of protection of human health and the environment through removal of chemicals of concern from the Site and off-site secure disposal or destruction. Placement of a soil cover or asphalt cap over the consolidated soils would provide an additional level of protectiveness by further reducing the potential for direct contact with the contaminants remaining on site and by reducing the potential for the remaining contaminants to leach to the Site groundwater. Should wetlands be disturbed by Site activities, they would be restored and protected under this Response Measure.

4.3.4.2 Compliance with ARARs

The effectiveness of the bioremediation process in complying with the chemical-specific ARARs is uncertain at this time and would need to be verified through performance of extensive bench- and pilot-scale treatability studies. Removal and off-site treatment and disposal, as well as capping, would allow for in compliance with chemical-specific ARARs. Should wetland areas be disturbed during the course of remedial action, their restoration would be performed in accordance with applicable state or federal location-specific ARARs. Compliance with other location-specific ARARs would be required and considered during the design phase. Compliance with action-specific ARARs would be required during implementation of the response measure and would also therefore be considered during the remedial design.

4.3.4.3 Long-Term Effectiveness and Permanence

To the extent that bioremediation is successful, excavation and treatment of contaminated soils greatly reduces the long-term risks associated with exposure to the contaminated soils because the toxicity of the contaminants would be reduced through the biological treatment process. The anaerobic bioremediation of the soils would also be a permanent remedy if the treatment process were effective. However, in the event that the effectiveness of the treatment process proves to be limited, this response measure also offers the availability of an appropriate off-site treatment/disposal facility as a contingency. Therefore, the long-term effectiveness and permanence of this aspect of the response measure cannot be definitively evaluated at this time.

The remaining components of the response measure, removal and off-site disposal, are permanent remedies with an acceptable level of long-term effectiveness. Excavation completed in connection with consolidation will effectively provide permanent remedies at the areas of the Site where this element of the response measure is implemented. Capping of the soils consolidated within the trench area will provide long-term protectiveness with regard to potential direct contact risks and migration potential of the contaminants.

Appropriate operations and maintenance actions and institutional controls would be needed to sustain the level of protectiveness and maintain the permanence of the response measure.

4.3.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The effectiveness of the bioremediation process in reducing the toxicity of the soils and impacted media at the Pulverizing Services Site to meet the RAOs is uncertain at this time and would need to be verified through performance of extensive bench- and pilot-scale treatability studies. However, as discussed during the technology screening analysis, bioremediation has been demonstrated to be effective in degrading chlorinated pesticides at other sites, including the Stauffer Management Company Site in Tampa, Florida. Should the effectiveness of the technology prove to be limited, this response measure offers an appropriate off-site treatment/disposal facility as a contingency measure.

Excavation, consolidation and capping of site media would result in reduction of mobility, as would disposal in a Subtitle C or D landfill. Treatment through off-site incineration would reduce the toxicity of any listed wastes, if encountered, which could not be bio-remediated.

4.3.4.5 Short-Term Effectiveness

Due to the uncertainty of the effectiveness of the bioremediation treatment process and the extensive bench- and pilot-scale treatability studies that would be required, this response measure could take up to several years to implement completely. However, placement of the contaminated media into controlled bio-piles would result in reduction of short-term risks associated with potential exposures. The off-site treatment and disposal elements of this response measure could be implemented quickly and would result in a short-term reduction of site risk.

Construction activities, including excavation, staging, consolidation and capping of contaminated soils, would result in significant material handling and dust generation. However, exposure could be reduced through the use of suitable protective clothing, equipment, good construction practice, and standard dust suppression techniques. Air monitoring would be required during the construction activities to ensure that a safe working environment is maintained and that no threat to public health or the environment is created by air emissions.

Other short-term risks associated with this response measure include inhalation of off-gases generated as a result of the on-Site soil treatment. These risks would be considered during the design phase and appropriate measures would be taken to collect and treat the off-gases.

4.3.4.6 *Implementability*

The ability of the bioremediation treatment process to reduce the concentrations in the Site soils to meet the RAOs is uncertain. The treatment process is highly dependent on Site-specific conditions such as soil type, nutrient availability, and the presence of oxygen. Therefore, extensive bench- and on-site pilot-scale treatability testing would be required to determine if anaerobic bioremediation could be effective in treating the Site soils to meet the RAOs. The bench- and pilot-scale treatability studies are estimated to require approximately twenty weeks each to complete, resulting in a study period of approximately one year. The actual time required for full-scale treatment to meet the remedial action objectives cannot be determined without first performing bench- and pilot-scale treatability studies. However, based on preliminary data from its application at other Sites, it is estimated that the treatment would require one to two years for completion, resulting in a total implementation timeframe of approximately three years.

Wetlands restoration (should it be required) is technically and administratively feasible and is accepted by regulatory agencies as a technique for rehabilitating disturbed wetland areas. Under this Response Measure, wetlands restoration may be delayed as the soils to be used for backfilling and restoring the wetland areas undergo the biotreatment process.

The remaining elements of this response measure, excavation, consolidation, capping, and off-site treatment and disposal, are proven technologies which can be readily implemented.

4.3.4.7 *Cost*

The estimated capital cost for this response measure ranges between 2.41 and 4.18 million dollars, based on the excavation, placement, treatment, consolidation and backfilling of approximately 13,000 tons of soil and trench material. This cost estimate assumes that the biological treatment would cost approximately $75 per ton. The total cost of this response measure ranges between 3.05 and 5.39 million dollars. As noted in the summary of the cost estimate which is provided in Appendix A, the mobilization and treatability study costs associated with this response measure are substantial.

4.3.5 Response Measure 4A: Excavation; Off-Site Low Temperature Thermal Desorption; Off-Site Landfilling/Incineration

This response measure involves the use of treatment and disposal technologies to reduce the toxicity of contaminants present at the Site. Reduction in toxicity would be achieved through off-site LTTD treatment, off-site landfilling, and incineration of Site soils and media containing contaminants of concern at concentrations in excess of the RAOs. Should the complete effectiveness of the technology prove to be limited, this response measure also offers appropriate off-site treatment/disposal options as a contingency measure.

Analysis of this response measure with respect to each of the detailed evaluation criteria is presented below.

4.3.5.1 Overall Protection of Human Health and the Environment

The off-site LTTD treatment process has been effective at other sites with similar COCs in achieving remedial goals and protecting human health and the environment. However, a pilot-scale treatability study would need to be performed to ensure the complete range of effectiveness of this technology in treating the range of soil types and media to potentially be encountered at the Pulverizing Services Site.

Based on discussions with facility operators, off-site LTTD treatment has been demonstrated to be successful in degrading chlorinated pesticides in concentrations less than 1,000 ppm. If successful, off-site LTTD would likely reduce the concentrations of the contaminants in the treated soils and media to acceptable levels and would thereby prevent degradation of the groundwater and subsurface soils. Should the complete effectiveness of the technology prove to be limited, this response measure also offers appropriate off-site treatment/disposal options as a contingency measure.

Excavation and landfilling/incineration will provide an acceptable level of protection of human health and the environment through removal of chemicals of concern from the Site and off-site secure disposal or destruction.

Should wetland areas be disturbed during Site activities, they would be restored and protected in accordance with federal or state requirements.

4.3.5.2 Compliance with ARARs

Based on the results of a bench-scale treatability study, the off-site LTTD process could likely treat the Site soils to meet the chemical-specific ARARs. Removal and off-site treatment and disposal would also allow for compliance with chemical-specific ARARs. Should wetland areas be disturbed during the course of remedial action, their restoration will be performed in accordance with applicable state or federal location-specific ARARs. Compliance with other location-specific ARARs would be required and considered during the design phase. Compliance with action-specific ARARs would be required during implementation of the response measure and would also therefore be considered during the remedial design.

4.3.5.3 Long-Term Effectiveness and Permanence

Over the long-term, excavation and treatment of contaminated soils would effectively reduce the risks associated with exposure because the toxicity of the contaminants would be reduced through the LTTD process. Treatment of soils at an off-site LTTD facility would also be a permanent option. However, should the complete effectiveness of the technology in treating the range of soil types and media to potentially be encountered at the Site be limited, this response measure also offers an appropriate off-site treatment/disposal option as a contingency measure.

The remaining components of the response measure, removal and off-site disposal, are permanent remedies with an acceptable level of long-term effectiveness.

4.3.5.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Based on the results of a limited bench-scale treatability study, the off-site LTTD technology could be effective in reducing the toxicity of the soils and impacted media at the Pulverizing Services Site to meet the RAOs. However, an additional pilot-scale treatability study would need to be performed to ensure that the technology could be completely effective on a fully-operational scale in treating the range of soil types and media to potentially be encountered at the Pulverizing Services Site.

Excavation of site media would result in reduction of mobility, as would disposal in a Subtitle C or D landfill. Treatment through off-site incineration would reduce the toxicity of any hazardous wastes, if encountered, which could not be landfilled at a Subtitle C facility.

4.3.5.5 Short-Term Effectiveness

The effectiveness of the off-site LTTD treatment process in reducing site risks would need to be verified through the performance of a pilot-scale treatability study which could delay implementation of the remedy in the short-term. However, the off-site disposal elements of this response measure could be performed quickly to result in a short-term reduction of Site risk.

Construction activities, including excavation and staging of contaminated soils, would result in significant material handling and dust generation. However, exposure could be reduced through the use of suitable protective clothing and equipment, good construction practice, and standard dust suppression techniques. Air monitoring would be performed during the construction activities to ensure that a safe working environment is maintained and that no threat to public health or the environment is created by dust emissions.

Other concerns associated with implementation of this technology include the potential for accidents involving heavy trucks transporting contaminated media off site through a substantially residential area; as well as concerns related to the safe handling of contaminated materials once they reach the selected off-site LTTD facility.

4.3.5.6 Implementability

The implementability of this response measure is primarily dependent on the availability of a permitted off-site LTTD facility which can treat the range of impacted media from the Pulverizing Services Site. Therefore, pilot-scale treatability testing will likely be required. The remaining elements of this response measure, excavation and off-site treatment and disposal, are proven technologies which can be readily implemented.

Wetlands restoration, if required, is technically and administratively feasible and is a proven and accepted technique for rehabilitating disturbed wetland areas.

4.3.5.7 Cost

The estimated capital cost for this response measure ranges between 2.62 and 4.68 million dollars and is based on the excavation, placement, treatment, and backfilling of approximately 13,000 tons of soil and trench material. This cost estimate assumes that off-Site LTTD would cost approximately $155 per ton including the transportation of treated soils back to the site for use as backfill. The total cost of this response measure ranges between 3.04 and 5.40 million dollars. A summary of the cost estimate is provided in Appendix A.

4.3.6 Response Measure 4B: Excavation; Off-Site Low Temperature Thermal Desorption; Off-Site Landfilling and Incineration of Soils in Excess of the RA 10^{-6} Construction Worker Scenario, Consolidation and covering of Remaining On-Site Soils in Excess of the RA 10^{-6} Commercial Site Worker Criteria

This response measure involves the use of treatment and disposal technologies to reduce the toxicity of contaminants present at the Site and a containment technology that serves as a barrier to reduce the potential for exposure to the soils remaining at the Site which would contain concentrations in excess of the RA 10^{-6} Commercial Site Worker Criteria. Reduction in toxicity would be achieved through off-site LTTD treatment and incineration of Site soils and media containing contaminants of concern at concentrations in excess of the RA 10^{-6} Construction Worker Scenario.

Containment of lesser impacted soils at the Site would be accomplished through the use of a soil cover or asphalt cap as described in Section 4.1.2.

Should the complete effectiveness of the treatment technology element of this response measure prove to be limited, this response measure also offers the availability of appropriate off-site treatment/disposal options as a contingency measure.

Analysis of this response measure with respect to each of the detailed evaluation criteria is presented below.

4.3.6.1 Overall Protection of Human Health and the Environment

The off-site LTTD treatment process has been effective at other sites with similar COCs in achieving remedial goals and protecting human health and the environment. However, a pilot-scale treatability study would need to be performed to ensure the complete range of effectiveness of this technology in treating the range of soil types and media to potentially be encountered at the Pulverizing Services Site.

Based on discussions with facility operators, off-site LTTD treatment has been demonstrated to be successful in degrading chlorinated pesticides in concentrations less than 1,000 ppm. If successful, off-site LTTD would likely reduce the concentrations of the contaminants in the treated soils and media to acceptable levels and would thereby prevent degradation of the groundwater and subsurface soils. Should the complete effectiveness of the technology prove to be limited, this response measure also offers appropriate off-site treatment/disposal options as a contingency measure.

Excavation and landfilling/incineration will provide an acceptable level of protection of human health and the environment through removal of chemicals of concern from the Site and off-site secure disposal or destruction.

Should wetlands areas be disturbed during Site activities, they would be restored in accordance with applicable Federal and State requirements.

By eliminating the possibility of direct contact, inhalation, and ingestion of the contaminated soil, this containment of impacted soils containing COCs less than the RA 10^{-6} Construction Worker Scenario, but greater than the RA 10^{-6} Restricted Use Scenario criteria, will substantially reduce the human health risks associated with the Site. The cover/caps will also prevent the migration of Site contaminants via erosion and wind dispersion since the contaminants will be contained beneath a minimum of two feet of soil that will be vegetated to limit the effects of erosion. Since soils containing COCs in excess of the RA 10^{-6} Construction Worker Scenario will be removed and treated/disposed of off site, there will no longer be impacts to the Site's groundwater by the infiltration of stormwater. Through proper construction and maintenance, the soil cover with impermeable geomembrane and asphalt caps would be protective of human health and the environment, indefinitely.

4.3.6.2 *Compliance with ARARs*

Based on the results of a bench-scale treatability study, the off-site LTTD process could likely treat the Site soils to meet the chemical-specific ARARs. Removal and off-site treatment and disposal would also meet the chemical-specific ARARs. The containment portions of this remedy meet the intent of the chemical-specific ARARs by preventing direct contact with the contaminants and mitigating residual contaminant migration.

Should wetland areas be disturbed during the course of the remedial action, their restoration will be performed in accordance with applicable state or federal location-specific ARARs. Compliance with other location-specific ARARs would be required and considered during the design phase. Compliance with action-specific ARARs would be required during implementation of the response measure and would also therefore be considered during the remedial design.

4.3.6.3 *Long-Term Effectiveness and Permanence*

Over the long term, excavation and treatment of contaminated soils would effectively reduce the risks associated with exposure because the toxicity of the contaminants would be reduced through the LTTD process. Treatment of soils at an off-site LTTD facility would also be a permanent remedy. However, should the complete effectiveness of the technology in treating the range of soil types and media to potentially be encountered at the Site prove to be limited, this response measure also offers appropriate off-site treatment/disposal options as a contingency measure.

The removal and off-site disposal components of the response measure are permanent remedies with an acceptable level of long-term effectiveness. The remaining portion of this alternative, covering contaminated soils containing COCs less than the RA 10^{-6} Construction Worker Scenario, but greater than the RA 10^{-6} Commercial Site Worker Criteria, eliminates the long-term risks associated with direct contact, inhalation, and ingestion of the remaining contaminated media by providing a barrier between the contaminated media and receptors.

The permanence of this response measure is dependent on the design life of the cover/cap, assuming normal conditions of wear and tear. Periodic inspection and maintenance, including re-vegetation and sealing of cracks in asphalt, would be required to mitigate the effects of erosion/weathering and preserve the integrity of the soil cover and asphalt caps. Institutional controls to be implemented as part of this response measure would also aid in managing future risks associated with the remaining impacted soils contained on site.

4.3.6.4 *Reduction of Toxicity, Mobility, or Volume Through Treatment*

Based on the results of a bench-scale treatability study, the off-site LTTD technology could be effective in reducing the toxicity of the soils and impacted media at the Pulverizing Services Site to meet the RAOs. However, an additional pilot-scale treatability study would need to be performed to ensure that the technology could be completely effective on a fully-operational scale in treating the range of soil types and media to potentially be encountered at the Pulverizing Services Site.

Excavation of site media would result in reduction of mobility, as would disposal in a Subtitle C or D landfill. Treatment through off-site incineration would reduce the toxicity of any hazardous wastes which could not be landfilled at a Subtitle C facility.

Since soils containing COCs in excess of NJDEP's will be removed from the Site, there will no longer be impacts to the Site's groundwater via infiltration of stormwater. Capping/covering of soils containing less than the RA 10^{-6} Construction Worker Scenario, but greater than the RA 10^{-6} Commercial Site Worker Criteria, will also reduce the mobility of the contaminants by preventing migration via wind dispersion of contaminated particulates, as well as transport of the contaminants via erosion. This portion of the response measure does not employ treatment to reduce the toxicity or volume of the contaminants. Although it is anticipated that the toxicity of the contaminants would be reduced over time through natural processes such as attenuation and biodegradation, the overall effectiveness of such natural processes cannot be predicted at this time.

4.3.6.5 *Short-Term Effectiveness*

The short-term effectiveness of the off-site LTTD treatment process in reducing site risks would need to be verified through the performance of a pilot-scale treatability study, which would delay implementation of the remedy. However, the off-site disposal elements of this response measure could be performed quickly to result in a short-term reduction of site risk.

The containment component of this response measure can be implemented quickly to reduce the current Site risks in the short term.

Construction activities, including excavation, consolidation of selected soils and staging of contaminated soils in excess of the RA 10^{-6} Construction Worker Scenario would result in significant material handling and dust generation. Exposure could be reduced through the use of suitable protective clothing, equipment, good construction practice, and standard dust suppression techniques. Air monitoring would be required during the construction activities to ensure that a safe working environment is maintained and that no threat to public health or the environment is created by air emissions.

Other concerns associated with implementation of this technology include the potential for accidents involving heavy trucks transporting contaminated media off site through a substantially residential area; as well as concerns related to the safe handling of contaminated materials once they reach the selected off-site LTTD facility.

4.3.6.6 *Implementability*

The implementability of this response measure is primarily dependent on the availability of a permitted off-site LTTD facility which can safely handle and treat the impacted media from the Pulverizing Services Site. Therefore, a pilot-scale treatability study would likely be required. Should an appropriate facility not be available, this response measure offers an appropriate off-site treatment/disposal facility as a contingency measure. The excavation and off-site treatment and disposal elements of this response measure are proven technologies which can be readily implemented.

Wetlands restoration, if required, is technically and administratively feasible and it is a proven and accepted technique for rehabilitating disturbed wetland areas.

The soil cover with impermeable geomembrane and asphalt/RCRA caps are technically feasible to construct, as the required construction materials, services, and equipment that would be utilized are readily available.

4.3.6.7 *Cost*

The estimated capital cost for this response measure ranges from approximately 2.15 to 3.83 million dollars and, based on the excavation, placement, treatment, and backfilling of approximately 13,000 tons of soil and trench material. This cost estimate assumes that off-Site LTTD would cost approximately $155 per ton including the transportation of treated soils back to the site for use as backfill. The total range costs of this response measure ranges from 2.74 to 4.99 million dollars. A summary of the cost estimate is provided in Appendix A.

4.3.7 Response Measure 5A: Excavation; Off-Site Incineration; Off-Site Landfilling

This response measure involves the use of treatment and disposal technologies to reduce the toxicity of contaminants on site. Reduction in toxicity would be achieved through off-site incineration and off-site landfilling of Site soils and media containing chemicals of concern at concentrations in excess of the RAOs.

Analysis of this response measure with respect to each of the detailed evaluation criteria is presented below.

4.3.7.1 *Overall Protection of Human Health and the Environment*

Excavation and off-site landfilling/incineration will provide an acceptable level of protection of human health and the environment through removal of chemicals of concern from the Site and off-site secure disposal or thermal destruction. Permanent removal of contaminated media from the Site would prevent degradation of the groundwater and soils and would eliminate the potential for direct contact with the chemicals of concern.

Should wetlands areas be disturbed during Site activities, they would be restored and protected in accordance with federal or state requirements.

4.3.7.2 Compliance with ARARs

Removal and off-site treatment and disposal can be performed in compliance with chemical-specific ARARs. Should wetland areas be disturbed during the course of the remedial action, their restoration would be performed in accordance with applicable state or federal location-specific ARARs. Compliance with other location-specific ARARs would be required and considered during the design phase. Compliance with action-specific ARARs would be required during implementation of the response measure and would also therefore be considered during the remedial design.

4.3.7.3 Long-Term Effectiveness and Permanence

Excavation and incineration of contaminated soils would reduce the risks associated with exposure to the contaminated soils because the toxicity of the contaminants would be reduced through the incineration process. Removal and off-site incineration are permanent remedies with an acceptable level of long-term effectiveness.

4.3.7.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Excavation of site media would result in reduction of mobility, as would disposal in a Subtitle C or D landfill. Treatment through off-site incineration would reduce the toxicity of any contaminated media which could not be landfilled at a Subtitle C or D facility.

4.3.7.5 Short-Term Effectiveness

The excavation and off-site incineration and disposal of contaminated media would result in a short-term reduction of Site risk. Construction activities, including excavation and staging of contaminated soils, would result in significant material handling and dust generation. However, exposure could be reduced through the use of suitable protective clothing and equipment, good construction practice, and standard dust suppression techniques. Air monitoring would be performed during the construction activities to ensure that a safe working environment is maintained and that no threat to public health or the environment is created by dust emissions.

Other concerns associated with implementation of this technology include the potential for accidents involving heavy trucks transporting contaminated media off site through a substantially residential area; as well as concerns related to the safe handling of contaminated materials once they reach the selected off-site LTTD facility.

4.3.7.6 Implementability

This response measure is both technically and administratively feasible to construct, as the required construction materials, services, and equipment that would be utilized are readily available. The major engineering considerations associated with this response measure include design of a soil staging pad, appropriate "clean" access roads, and a vehicle decontamination pad.

Wetlands restoration (should it be required) is technically and administratively feasible and is a proven and accepted technique for rehabilitating disturbed wetland areas.

4.3.7.7 Cost

The estimated capital costs for this response measure range from approximately 2.81 to 5.25 million dollars based on the excavation, treatment, and disposal of approximately 13,000 tons of soil and trench material. This cost estimate assumes that off-site incineration and landfilling would cost approximately $800.00 and $55.00 per ton, respectively. The total cost of this response measure is estimated to range from 3.26 and 6.06 million dollars. A summary of the cost estimate is provided in Appendix A.

4.3.8 Response Measure 5B: Excavation; Off-Site Incineration and Off-Site Landfilling of Soils in Excess of the RA 10^{-6} Construction Worker Scenario; and Consolidation and Covering of Remaining On-Site Soils in Excess of the RA 10^{-6} Commercial Site Worker Criteria

This response measure involves the use of off-site treatment and disposal technologies to reduce the toxicity of contaminants, and a containment technology to reduce the potential for direct contact exposure to the contaminated soils remaining at the Site in excess of the RA 10^{-6} Commercial Site Worker Criteria. Reduction in toxicity would be achieved through off-site landfilling and incineration of Site soils and media containing contaminants of concern at concentrations in excess of the RA 10^{-6} Construction Worker Scenario. Reductions in mobility would be achieved through containment of lesser impacted soils at the Site using a soil cover or asphalt cap as described in Section 4.1.2.

Analysis of this response measure with respect to each of the detailed evaluation criteria is presented below.

4.3.8.1 Overall Protection of Human Health and the Environment

As described in Section 4.3.7.1, excavation and landfilling/incineration will provide an acceptable level of protection of human health and the environment through removal of chemicals of concern from the Site and off-site secure disposal or destruction.

By eliminating the possibility of direct contact, inhalation, and ingestion of the contaminated soil, the containment of impacted soils containing concentrations of

COCs less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria will substantially reduce the human health risks associated with the Site. The cover/caps will also prevent the migration of Site contaminants via erosion and wind dispersion since the contaminants will be contained beneath a minimum of two feet of soil that will be vegetated to limit the effects of erosion. Since soils containing COCs in excess of the RA 10^{-6} Construction Worker Scenario will be removed and treated/disposed of off site, there will no longer be impacts to the Site's groundwater by the infiltration of stormwater. Through proper construction and maintenance, the soil cover with impermeable geomembrane and asphalt caps would be protective of human health and the environment, indefinitely.

Should wetlands areas be disturbed during Site activities, they would be restored and protected in accordance with federal or state requirements.

4.3.8.2 Compliance with ARARs

Removal and off-site treatment and disposal can be achieved in compliance with chemical-specific ARARs. The containment portion of this remedy meets the intent of the chemical-specific ARARs by preventing direct contact with the contaminants and mitigating residual contaminant migration. Should wetland areas be disturbed during the course of the remedial action, their restoration will be performed in accordance with applicable state or federal location-specific ARARs. Compliance with other location-specific ARARs would be required and considered during the design phase. Compliance with action-specific ARARs would be required during implementation of the response measure and would also therefore be considered during the remedial design.

4.3.8.3 Long-Term Effectiveness and Permanence

The removal of off-site treatment and disposal components of this response measure are permanent remedies with an acceptable level of long-term effectiveness. The remaining portion of this response measure -covering impacted soils containing COCs in concentrations that are less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria- eliminates the long-term risks associated with direct contact, inhalation and ingestion of the impacted media remaining on site by providing a barrier between the contaminated media and receptors.

The permanence of this response measure is dependent on the design life of the cover/cap, assuming normal conditions of wear and tear. Periodic inspection and maintenance, including re-vegetation and sealing of cracks in asphalt, would be required to mitigate the effects of erosion/weathering and preserve the integrity of the soil cover and asphalt caps. Institutional controls to be implemented as part of this response measure would also aid in managing future risks associated with the remaining impacted soils contained on Site.

4.3.8.4 *Reduction of Toxicity, Mobility, or Volume Through Treatment*

Excavation of site media would result in reduction of mobility, as would disposal in a Subtitle C or D landfill. Treatment through off-site incineration would reduce the toxicity of any soils or media which could not be landfilled at a RCRA Subtitle C or D facility.

Since soils containing COCs in excess of the RA 10^{-6} Construction Worker Scenario would be removed from the Site, the potential would no longer exist for the Site's groundwater to be impacted via infiltration of stormwater runoff. Capping/covering of soils containing concentrations less than the RA 10^{-6} Construction Worker Scenario but greater than the RA 10^{-6} Commercial Site Worker Criteria would also reduce the mobility of the contaminants by preventing migration via wind dispersion of contaminated particulates, as well as transport of the contaminants via erosion.

It is also anticipated that the toxicity of the contaminants remaining on site would be reduced over time through natural processes such as attenuation and biodegradation. However, the overall rate of natural remediation cannot be predicted at this time.

4.3.8.5 *Short-Term Effectiveness*

The off-site treatment and disposal elements of this response measure would result in a short-term reduction of Site risk as impacted materials would be permanently removed from the Site and secured or destroyed. Likewise, the containment component of this response measure can be implemented quickly to reduce the current Site risks in the short term.

Construction activities, including excavation, consolidation of selected soils, and staging of soils containing concentrations in excess of the RA 10^{-6} Construction Worker Scenario, would result in significant material handling and dust generation. However, exposure could be reduced through the use of suitable protective clothing and equipment, good construction practice, and standard dust suppression techniques. Air monitoring would be performed during the construction activities to ensure that a safe working environment is maintained and that no threat to public health or the environment is created by air emissions.

Other concerns associated with implementation of this technology include the potential for accidents involving heavy trucks transporting contaminated media off site through a substantially residential area; as well as concerns related to the safe handling of contaminated materials once they reach the selected off-site LTTD facility.

4.3.8.6 *Implementability*

The excavation and off-site treatment and disposal elements of this response measure are proven technologies which can be implemented using readily available equipment, services, and TSDFs.

The soil cover with impermeable geomembrane and asphalt caps are also technically feasible to construct, as the required construction materials, services, and equipment are readily available.

Wetlands restoration, if required, is technically and administratively feasible and is a proven and accepted technique for rehabilitating disturbed wetland areas.

4.3.8.7 Cost

The estimated capital costs for this response measure range from 2.54 and 4.18 million dollars. This cost is based on the excavation, treatment/disposal, consolidation, and backfilling of approximately 13,000 tons of soil and trench material. This cost estimate assumes that off-Site incineration and landfilling would cost approximately $800.00 and $55.00 per ton, respectively, including transportation costs. The total cost of this response measure ranges from approximately 3.51 and 5.40 million dollars. A summary of the cost estimate is provided in Appendix A.

4.4 COMPARATIVE ANALYSIS OF RESPONSE MEASURES

In this section, the response measures are compared in order to highlight the differences between them and determine their relative value in meeting the detailed evaluation criteria.

4.4.1 Overall Protection of Human Health and the Environment

Response Measure 1, No Action, does not include additional actions which would satisfy the intent of the remaining evaluation criteria, as discussed in subsequent sections. However, some activities have already occurred at the Site which have served to reduce the potential for exposure to Site contaminants. Primarily, a Site security fence was installed between 1987 and 1993 to control access onto the Site. In addition, the current Site zoning as Specially Restricted Industrial is a form of administrative institutional control which has already been enacted. This zoning will also serve to limit the potential for exposure to Site contaminants.

Response Measure 2, Selective Excavation, Consolidation, and Capping, is protective of human health because it eliminates direct contact exposure to, and inhalation and ingestion of, the Site contaminants. Response Measure 2 would be protective of the environment (groundwater, surface water, and air) because a cap or soil cover would prevent the migration of the Site contaminants via wind dispersion and erosion, and would also prevent infiltration of stormwater runoff, thereby eliminating the potential for leaching of residual contamination into the subsurface soils and groundwater.

The overall ability of Response Measures 3A and 3B to be protective of human health and the environment is dependent on the overall effectiveness of the anaerobic bioremediation treatment process in treating Site soils to meet the selected PRGs. However, the overall effectiveness of the bioremediation treatment process cannot be determined at this time because extensive bench- and pilot-scale treatability testing would need to be performed. Therefore, Response Measures 3A and 3B offer the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the bioremediation treatment process is limited.

The overall ability of Response Measures 4A and 4B to be protective of human health and the environment is dependent on the effectiveness of the LTTD treatment process in treating the wide range of soil types and media potentially to be encountered at the Site. Although the LTTD treatment process has been successful in treating soils impacted by chlorinated organic pesticides from other sites, a pilot-scale treatability study would need to be performed to determine the complete effectiveness of the LTTD treatment process in treating Pulverizing Services Site media. Response Measures 4A and 4B also offer the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the LTTD treatment process proves limited.

Response Measure 5A will provide an acceptable level of protection of human health and the environment through removal of impacted media from the Site and off-site secure disposal or thermal destruction. Permanent removal of contaminated media from the Site would prevent further degradation of the groundwater and surface soils. Response Measure 5B will also provide an acceptable level of protection for human health and the environment. Although soils which contain concentrations exceeding the RA 10^{-6} Commercial Site Worker Criteria would remain on site, these soils would be capped or covered, thereby eliminating the possibility of direct contact, inhalation, and ingestion. The soil cover/cap will also be protective of the environment as it will prevent the migration of Site contaminants via erosion and wind dispersion, and will prevent the infiltration of stormwater runoff.

Any wetlands which may be disturbed by Site activities would be restored and protected under each of the Response Measures.

4.4.2 Compliance with ARARs and TBCs

Response Measure 1, No Action, does not satisfy the chemical-specific or location-specific ARARs. Action-specific ARARs do not apply to this response measure as no additional actions are taken to reduce the contaminant concentrations at the Site.

The purpose of the risk-based PRGs is to prevent unacceptable exposure of receptors to contaminated Site media. Response Measure 2 meets the intent of the chemical-specific ARARs and PRGs by preventing direct contact with the contaminants and mitigating residual contaminant migration. The ability of the bioremediation treatment technology associated with Response Measures 3A and 3B to contribute to the achievement of the chemical-specific ARARs cannot be determined at this time. Extensive treatability studies would need to be performed in order to determine the effectiveness of the bioremediation process in treating the media at the Pulverizing Services Site to meet the selected PRGs. Therefore, should the treatment portion of Response Measures 3A and 3B have limited effectiveness in achieving the PRGs, these response measures offer the availability of an appropriate off-site treatment/disposal facility as a contingency.

Based on the results of a limited bench-scale study, the LTTD treatment portion of Response Measures 4A and 4B should be capable of treating Site media to meet the PRGs. However, a pilot-scale study would be necessary to provide confirmation. Response Measures 4A and 4B also offer the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the LTTD treatment process proves limited. The treatment and disposal technologies associated with Response Measures 5A and 5B would allow for compliance with the chemical-specific ARARs and PRGs. Moreover, as mentioned above, the capping portion of Response Measure 5B meets the intent of the chemical-specific ARARs and PRGs by preventing direct contact with the contaminants and mitigating residual contaminant migration.

Response Measures 2, 3A, 3B, 4A, 4B, 5A and 5B could be designed and implemented to comply with location- and action-specific ARARs and TBCs.

4.4.3 Long-Term Effectiveness and Permanence

Response Measure 1, No Action, satisfies neither the long-term effectiveness nor the permanence criteria as the remediation goals derived for protectiveness of human health and the environment would not be met. Response Measure 2, Selective Excavation, Consolidation, and Capping, would achieve the remedial action objectives and would be effective in reducing the long-term risks associated with the Site. However, the permanence of Response Measure 2 would be dependent upon the long-term maintenance of the cap/cover. The degree to which on-site anaerobic bioremediation would contribute to the overall effectiveness of Response Measures 3A and 3B cannot be determined at this time. The ability of the bioremediation treatment process to treat the soils to meet the remedial action objectives is uncertain and would need to be verified through performance of extensive bench- and pilot-scale treatability studies. Therefore, Response Measures 3A and 3B offer the availability of an appropriate off-site treatment/disposal facility as a contingency if the treatment process proves to have limited effectiveness.

Likewise, the degree to which off-site LTTD would contribute to the long-term effectiveness and permanence of Response Measures 4A and 4B would need to be verified through performance of a pilot-scale study. However, based on bench-scale study results, it is likely that excavation and LTTD treatment of impacted media would reduce the risks associated with exposure because the toxicity of the contaminants would be reduced through the LTTD treatment process. Response Measures 4A and 4B also offer the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the LTTD treatment process proves limited. Response Measure 4A would be a permanent remedy. The permanence of Response Measure 4B would be dependent upon the proper and extended maintenance of the cap/cover.

Response Measure 5A would be an effective and permanent remedy. Excavation and incineration/landfilling of impacted media would reduce the risks associated with exposure as the impacted materials would be permanently removed from the Site and secured or destroyed. Response Measure 5B would also be an effective remedy, the permanence of which would be dependent upon the long-term maintenance of the cap/soil cover.

4.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Response Measure 1, No Action, does not reduce the toxicity, mobility, or volume of contaminants. However, it is likely that some reduction in toxicity will occur over time due to natural attenuation, flushing, and degradation of the contaminants. Response Measure 2 does not reduce the toxicity or volume of the contaminants, but does effectively reduce the mobility of the contaminants through containment. Although chemicals of concern would remain on site, they would be contained beneath a cap/cover, thereby reducing their mobility and eliminating direct-contact exposure risks.

The ability of the on-site anaerobic bioremediation portion of Response Measures 3A and 3B to reduce the toxicity and volume of the contaminants in the impacted media cannot be determined at this time. Extensive bench- and pilot-scale treatability testing must be performed to evaluate the overall effectiveness of the treatment process in reducing contaminant toxicity. Therefore, Response Measures 3A and 3B offer the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the treatment process proves limited. The capping portion of Response Measure 3B is a containment technology that would be effective in reducing the mobility of any contaminants remaining on site.

The level of effectiveness of the off-site LTTD portion of Response Measures 4A and 4B in reducing the toxicity and volume of contaminants in the impacted media would need to be verified through performance of a pilot-scale treatability study. Although LTTD has been successful in treating chlorinated pesticides at other sites, its complete effectiveness in treating the range of soil types and media which may potentially be encountered at the Pulverizing Services Site is uncertain. Therefore, Response Measures 4A and 4B offer the availability of an appropriate off-site treatment/disposal facility as a contingency in the event that the effectiveness of the treatment process proves limited. The capping portion of Response Measure 4B would reduce the mobility of any contaminants remaining on site, as they would be contained beneath a cap or cover which will prevent contaminant migration via erosion or wind dispersion.

Response Measures 5A and 5B would provide for reductions in the toxicity, volume and mobility of contaminants. Reductions in toxicity would be achieved through off-site incineration of impacted soils and media. Reductions in volume of contaminants present on site would be achieved through excavation and permanent removal (i.e., landfilling) from the Site of impacted soils and media. Finally, the capping portion of Response Measure 5B would reduce the mobility of contaminants, as the impacted materials remaining on site would be contained beneath a cap or cover which will prevent contaminant migration via erosion or wind dispersion.

4.4.5 Short-Term Effectiveness

Because Response Measure 1 does not include any additional actions to address the Site risks, it has effectively already been implemented. Response Measure 2 could be implemented quickly (less than one year) to achieve the remedial action objectives and reduce the Site risks to acceptable levels.

The ability of the respective treatment technologies to contribute to the short-term effectiveness of Response Measures 3A, 3B, 4A, and 4B in achieving the remedial action objectives is uncertain. Extensive bench- and pilot-scale treatability studies would be required to determine the effectiveness of the bioremediation treatment process. These treatability studies would result in an extended schedule. Therefore, Response Measures 3A and 3B could require up to several years to fully implement. Likewise, pilot-scale treatability testing would need to be performed to determine the complete effectiveness of the LTTD treatment process in treating Site media to meet the RAOs. Therefore, as described previously, Response Measures 3A, 3B, 4A, and 4B offer the availability of appropriate off-site treatment/disposal options as a contingency in the event that the treatment processes prove to be limited in effectiveness. Response Measures 5A and 5B could be implemented quickly to reduce the Site risks to acceptable levels and thereby achieve the remedial action objectives.

Because Response Measure 1 does not include any additional remedial activities, it does not result in any increased short-term risks. Of the remaining response measures, Response Measure 2, Selective Excavation, Consolidation, and Capping, involves the least intrusive activity and handling of contaminated materials, and, as a result, poses the least threat to workers and the surrounding community during implementation. Response Measures 3A and 3B require significantly more intrusive activity and handling of contaminated material because contaminated soils and trench materials that are to be treated by the bioremediated process must be excavated, transferred to the treatment area, treated on site, and backfilled after treatment. Although Response Measures 4A, 4B, 5A, and 5B would also require a significant amount of intrusive activity and handling of contaminated materials, the treatment elements of these Response Measures would be performed off site. Therefore, the short-term risks to Site workers and the surrounding community posed by the implementation of Response Measures 4A, 4B, 5A, and 5B would not be as great as those posed by the implementation of Response Measures 3A and 3B.

Additional concerns related to the implementation of Response Measures 4A, 4B, 5A, and 5B include the potential for accidents involving heavy trucks transporting contaminated materials off site to a marked increase in heavy truck traffic through a substantially residential area.

4.4.6 Implementability

Response Measure 1, No Action, does not include any additional activities to address the Site risks and has effectively already been implemented. Response Measure 2, Selective Excavation, Consolidation, and Capping, can be easily implemented using readily available equipment and materials, and any one of a number of qualified contractors.

The implementability and reliability of the anaerobic bioremediation portion of Response Measures 3A and 3B in achieving the remedial goals is uncertain and highly dependent on numerous engineering and design parameters that could impact the level of effectiveness of the anaerobic treatment process. Therefore, extensive bench- and pilot-scale treatability testing would be required to determine if the anaerobic bioremediation could be effective in treating the Site soils to meet the remedial goals. This treatability testing would require approximately one year or more to complete. Thus, implementation of the final Site remedy would be delayed and the Site risks would remain unmitigated during the time required to complete the treatability testing. In addition, if the treatability testing were performed and it was determined that the Site soils could be effectively treated to meet the RAOs using the anaerobic bioremediation treatment process, the time-frame for complete implementation would be significantly longer than any of the other response measures.

Based on the results of a bench-scale treatability study, off-site LTTD appears to be technically implementable. The administrative implementability of Response Measures 4A and 4B is uncertain at this time due to the limited number of permitted, off-site facilities than can safely handle and treat materials containing pesticides in concentrations similar to those found at the Site.

Response Measures 5A and 5B could be implemented using readily available equipment, materials, and services and have received administrative approval at several other regulated sites.

Should wetland areas be disturbed during the course of the remedial action, restoration techniques are administratively and technically feasible for each of the alternatives. However, wetland restoration, under Response Measures 3A and 3B, may be delayed as the soils to be used for backfilling and restoring the wetland areas would need to undergo the biotreatment process.

4.4.7 Cost

Table 4-2 presents a comparison of the costs for each of the eight response measures. As indicated by the table, there are no costs associated with Response Measure 1 as no additional activities would be performed to address Site risks.

4.4.8 Government and Community Acceptance

These criteria evaluate the technical and administrative issues and concerns that government agencies and the public may have regarding each of the response measures. Government and community comment will be solicited following issuance of the Draft RME Report, through a formal review and comment process. Government concerns will be addressed in the Final RME Report. Community acceptance issues will be addressed during development of the remedial action plan.

Table 4-2
PPG Pulverizing Services Site
Response Measure Cost Comparison

Response Measure		Scenario Descriptions		
		Low	Medium	High
Response Measure 1				
	Capital Costs	Not Applicable	Not Applicable	Not Applicable
	O & M Cost	Not Applicable	Not Applicable	Not Applicable
	Totals	Not Applicable	Not Applicable	Not Applicable
Response Measure 2				
	Capital Costs	1,339,063	1,339,063	1,339,063
	O & M Cost	21,709	21,709	21,709
	Totals	1,751,670	1,751,670	1,751,670
Response Measure 3A		5 / 90 / 5	10 / 80 / 10	10 / 70 / 20
	Capital Costs	3,023,694	3,830,825	5,113,263
	O & M Cost	21,709	21,709	21,709
	Totals	3,502,213	4,430,414	5,905,217
Response Measure 3B		5 / 90 / 5	10 / 80 / 10	10 / 70 / 20
	Capital Costs	2,413,875	3,295,075	4,177,075
	O & M Cost	722,737	722,737	722,737
	Totals	3,047,416	4,373,990	5,388,290
Response Measure 4A		5 / 90 / 5	10 / 80 / 10	10 / 70 / 20
	Capital Costs	2,621,094	3,419,375	4,679,313
	O & M Cost	21,709	21,709	21,709
	Totals	3,039,223	4,373,990	5,406,174
Response Measure 4B		5 / 90 / 5	10 / 80 / 10	10 / 70 / 20
	Capital Costs	2,148,188	3,010,688	3,830,188
	O & M Cost	724,829	724,829	724,829
	Totals	2,744,281	4,049,350	4,991,775
Response Measure 5A		90 / 10	80 / 20	70 / 30
	Capital Costs	2,811,500	4,031,438	5,251,375
	O & M Cost	21,709	21,709	21,709
	Totals	3,258,190	4,661,118	6,064,046
Response Measure 5B		90 / 10	80 / 20	70 / 30
	Capital Costs	2,536,438	3,355,938	4,175,438
	O & M Cost	730,547	730,547	730,547
	Totals	3,510,538	4,452,963	5,395,388

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Section 5

5.0 CONCLUSIONS AND RECOMMENDATIONS

The remedial action objectives for the Site were identified in Section 2.3 of this document and are as follows:

1) Remedial actions shall mitigate potential routes of human health and environmental exposures to pesticide-contaminated soils and media.

2) Remedial actions shall comply with ARARs to the extent practical.

3) Response Measure selection shall consider land use.

The effectiveness of each of the response measures developed in Section 4.0 in achieving the remedial action objectives, and the rationale for their elimination or further consideration, is summarized below.

Although no additional remedial activities would be performed to reduce potential Site risks, Response Measure 1, No Action, is protective of human health because the potential Site risks are currently controlled by the presence of a security fence along the Site perimeter. In addition, the Specially Restricted Industrial zoning currently in place would prevent residential developments from being constructed on the property. Response Measure 1 would not be sufficiently protective, however, should the Site be used for commercial business activities because it would not reduce risks to employees working at the Site. Response Measure 1 also does not include additional actions which would satisfy the intent of the evaluation criteria including compliance with ARARs, reduction of toxicity, and long and short-term effectiveness. Based on these rationale, Response Measure has been eliminated.

Response Measure 2, Selective Excavation, Consolidation, and Capping does not reduce the toxicity or volume of the contaminants through treatment, although it is likely that some reduction may occur over time due to degradation. Response Measure 2 is, however, protective of human health because it eliminates exposure to the Site contaminants. It would also be protective of the environment because a cap or cover would prevent the migration of the Site contaminants by wind dispersion and erosion, and would also prevent infiltration of stormwater runoff, thereby eliminating the potential for leaching of residual contamination into subsurface soils and groundwater.

Response Measure 2 includes the construction of a RCRA cap over highly contaminated soils and listed wastes, if encountered, and an asphalt cap or soil cover over the remaining impacted media containing COCs in concentrations greater than the RA 10^{-6} Commercial Site Worker PRGs. The RCRA cap component of this Response Measure would be applicable to the Site should highly contaminated media or RCRA listed wastes remain at the property following the completion of the remedial action. However, since the remaining response measures described herein include the removal and treatment of these materials, no highly contaminated media or listed waste will be left at the Site following completion of the remedial action. On this basis, the RCRA capping component of this response measure would not be appropriate for use at this Site.

The asphalt cap and soil cover components of this Response Measure, as described in Section 4.1.2, could play an integral role in any of the remaining response measures. As such, Response Measure 2 has been eliminated but the soil cover and asphalt cap components have been retained and are considered in the remaining Response Measures.

The ability of Response Measures 3A and 3B to meet the remedial action objectives is uncertain. Anaerobic biotreatment has met with some success in treating pesticide-contaminated soils in laboratory studies and during pilot studies at the Stauffer Management Site in Tampa, Florida. However, the ability of the biotreatment component of this Response Measure to treat impacted media from the Pulverizing Services Site to concentrations less than the PRGs cannot be determined at this time. Extensive bench- and on-Site pilot scale treatability studies would need to be performed to determine if this technology could be effective in treating Site soils and media. Moreover, if it is determined through treatability studies that the Site soils could be treated by anaerobic bioremediation to meet the PRGs, it is anticipated that treatment of Site media could require up to several years to complete. Thus, due to the uncertainty associated with the biological treatability component of Response Measures 3A and 3B, the length of time required to perform treatability studies, and the time frame required to fully implement the technology, Response Measures 3A and 3B have been eliminated from further consideration.

Response Measures 5A and 5B will provide an acceptable level of protection of human health and the environment through removal of impacted media from the Site and off-site secure disposal or thermal destruction at properly permitted facilities. These response measures would also be protective of the environment because permanent removal of contaminated media from the Site would also prevent degradation of underlying soils and groundwater.

Response Measure 5A complies with ARARs, is effective in both the long- and short-term, reduces the toxicity, mobility, and volume of the contaminants through treatment, and can be readily implemented. Response Measure 5B also complies with the detailed evaluation criteria, although soils that contain COC concentrations between the RA 10^{-6} Site Worker PRGs and RA 10^{-6} Construction Worker PRGs would remain on site and be contained by either an asphalt cap or soil cover described in Section 4.1.2. The capping or covering of soils which contain COC concentrations between these PRGs will eliminate exposure to the Site contaminants. It would also be protective of the environment because a cap or cover would prevent the migration of the Site contaminants by wind dispersion and erosion, and would also prevent infiltration of stormwater runoff, thereby elimination the potential for leaching of residual contamination into the subsurface soils and groundwater.

Response Measures 5A and 5B do not however, provide for treatment *and* re-use of impacted soils following application of the selected Response Measure. Therefore, they have been eliminated because they do not provide any added benefit over Response Measures 4A and 4B.

Recommended Response Measures

Response Measure 4A, Excavation, Off-site LTTD, Landfilling, and Incineration is the recommended Response Measure for the remediation of impacted soils and media at the Site and for the elimination of Site-related risks. Each of the components of Response Measure 4A has been proven effective at other sites with similar COCs in achieving remedial goals and protecting human health and the environment. Response Measure 4A also satisfies the detailed evaluation criteria and provides for the re-use of Site soils for backfill following off-site LTTD treatment.

Furthermore, should an asphalt cap or soil cover over impacted soils containing COC concentrations between the RA 10^{-6} Commercial Site Worker PRGs and the RA 10^{-6} Construction Worker PRGs prove beneficial in hastening the remedy or to meet specific project needs, Response Measure 4B can serve as a contingency to Response Measure 4A. Response Measure 4B would still satisfy the detailed evaluation criteria and remedial action objectives and would provide for the re-use of soils following treatment. Additionally, it would be effective in eliminating the long-term risks associated with the Site.

Prior to implementation of Response Measure 4A, a pilot scale treatability study would need to be performed to ensure that off-site LTTD can effectively treat the range of soil types and media which could potentially be encountered at the Site. Should treatability studies prove successful but treatment limitations develop during full-scale implementation, this Response Measure offers the availability of alternative off-site treatment/disposal options (i.e., landfilling and incineration).

Similarly, should the selected off-Site LTTD facility prove unable to safely handle and treat the materials from the Site, an alternative off-site treatment/disposal option is available. However, based on conversations with off-site LTTD operators and the proven performance of the landfilling and incineration components of this preferred remedy, Response Measure 4A should provide for a successful elimination of Site risks posed by the contaminants in Site soils and media.

In summary, Response Measure 4A, Excavation, Off-site LTTD, Landfilling, and Incineration is the most appropriate response measure for the following reasons:

1) This response measure utilizes technologies which have been proven to be successful in treating similar COCs at other sites and is a permanent remedy consistent with the anticipated future use of the property.

2) Response Measure 4A provides for the re-use of soils as backfill following off-site LTTD treatment.

3) The removal of impacted soils from the Site will eliminate the potential for leaching of residual contamination into the subsurface soils and underlying groundwater.

4) Response Measure 4A completely satisfies the seven detailed evaluation criteria, as described in Section 4.0.

5) Should treatment limitations develop during full-scale implementation, the response measure offers the availability of alternative off-site treatment disposal options as a replacement for off-site LTTD.

Response Measure 4B is an appropriate contingency Response Measure for the following reasons:

1) This response measure utilizes technologies which have been proven to be successful in treating similar COCs at other sites and is a permanent remedy consistent with the future use of the property.

2) Response Measure 4B will satisfy the detailed evaluation criteria.

3) Response Measure 4B provides for the re-use of soils as backfill following off-site LTTD treatment.

4) Although contaminated materials would remain on site, Response Measure 4B would also be protective of human health and the environment. A cap or cover would: eliminate the potential for exposure to these contaminants; prevent the migration of the Site contaminants by wind dispersion and erosion; and prevent infiltration of stormwater runoff, thereby eliminating the potential for leaching of residual contamination into the subsurface soils and groundwater.

Based on the foregoing rationale, Response Measure 4A, with Response Measure 4B as a contingency, is the recommended Response Measure for the Site.

Attachment A

PPG

PPG Industries, Inc.
Post Office Box 2009 Allison Park, Pennsylvania 15101 USA Telephone: (412) 492-5200

Engineering
Environmental
[illegible]

May 28. 1997

John Osolin
US Environmental Protection Agency
290 Broadway
New York, New York

Subject: Pulverizing Services - On-Site Low Temperature Thermal Desorption

Dear John:

PPG has investigated in significant detail the possible application of Low Temperature Thermal Desorption (LTTD) as an on-site remedial technology at the Pulverizing Services site. Focus Environmental performed a Treatability Study on behalf of PPG to test the applicability of this technology to Pulverizing Services contaminated site soils. This study confirmed that LTTD was effective in reducing the concentrations of contaminants of concern well below the Preliminary Remediation Goals for site soils. However, in its evaluation of the technology, PPG has identified a number of concerns. In particular, PPG has significant safety and emissions concerns. The sensitive nature of these concerns make it uncertain that a sufficient factor of safety can be designed into an on-site system, considering the mixed commercial and residential nature of the surrounding community.

PPG takes seriously the concerns of adjacent property owners and the community. While we have not performed a comprehensive community relations program, we have been in contact with a number of neighbors and town officials.

PPG notes the zoning of this property by the Town of Moorestown as Specially Restricted Industrial. The intent of SRI districts is to encourage only those types of uses which would not constitute a hazard or nuisance to residents of adjacent areas. We particularly note the use restrictions under section 180-69 of the Moorestown Code which prohibits "smoke, odors, fumes, gases, dust or powdered waste to be emitted into the air nor vibrations, noises or glare of such a nature likely to create any nuisance, physical discomfort or irritation or property damage on adjacent or nearby lots." We believe that implementation of an on-site LTTD technology would potentially create the type of nuisances the Town is trying to prevent in this area.

A review of specific concerns associated with this alternative are presented below.

1. Community Acceptance - From the standpoint of community acceptance, LTTD appears to combine the least desirable characteristics of the alternatives considered for this site. This site is in a mixed residential, commercial and light industrial area. Implementation of this alternative would maximize noise, dust and the potential for off-site release of contaminants. There would be a significant number of workers on site for an extended time. The appearance of the LTTD system and ancillary equipment would be unattractive to say the least. LTTD vendors typically recommend 24 hour per day operations.

2. Operations Safety - Physicians are taught "First do no harm". In PPG's view it is important that whatever is done to address environmental contamination, we should be careful not to place any of the site workers at risk. It is vital that site workers be well trained in the operation of the LTTD systems, over and above any OSHA required training. There are moving mechanical feeding equipment, high temperatures, and chemical byproducts that must be handled carefully. In our discussions with other parties who have implemented this technology on-site, we have been made aware of significant operator turnover. In our view, this compromises our ability to assure that operators will be well trained and perform in a safe manner. If this were an ongoing operating site, where we were able to control the personnel and ensure their long term performance, we would implement appropriate programs to ensure operator safety.

3. Off-Site Releases - PPG has identified as a significant concern the potential for off-site releases of contaminants. There are residences as well as a food processing facility adjacent to the site. For this reason, any excavation would be done in a slow, careful manner with adequate dust suppression. The additional handling necessitated by LTTD (materials preparation, screening of debris, feeding, handling wastes, etc.) would increase the opportunities for off-site releases. In addition, any excursions in the emissions control system, or any byproducts formed would add to potential concerns.

4. Byproduct Formation - While LTTD is intended to be a non-destructive technology, there are reactions that evidently take place during the treatment process. Results of the Treatability Study demonstrated that while contaminants were removed from the soils, it was not possible to complete a mass balance for those constituents. In other words, what went into the test unit did not equal what was collected on the outlet plus what remained in the soils. This indicates that either the collection system was not efficient, or that reactions took place in the unit which converted the initial contaminants into other constituents. Neither is a desirable result. Possible byproducts include dioxins, hydrochloric acid, SO_x, and a potentially wide variety of unidentified chemicals. While it may be possible to design and operate a system that can address these concerns, that would involve significant research and/or design and would likely reduce or eliminate any potential cost savings attributed to LTTD, since there are other viable remedial technologies available.

5. Emissions Controls - There are two typical types of emissions control systems used on LTTD systems. These are thermal oxidation and non-destructive or capture technologies. Thermal oxidation involves the destruction of contaminants through burning at an elevated temperature after they have been separated from the soils. While this is an appropriate technology for petroleum hydrocarbons, it is less effective for complex chemicals such as chlorinated pesticides and may lead to undesirable byproduct formation. Non-destructive technologies for emissions control typically include a series of control units, possibly

including a baghouse, a cyclone, a water scrubber and carbon adsorption. Each of these units must be designed and operated properly to ensure they remove contaminants to an appropriate level. Each unit also generates wastes (baghouse dusts, waste water, contaminated carbon) which must then be handled and disposed of separately. The increased handling of concentrated contaminants increases potential worker exposure.

6. Noise - Noise is generated from excavation equipment, material handling equipment, desorption chamber and emissions controls. Given close proximity to commercial and residential properties, it would be necessary to provide noise abatement. The selection of noise abatement would depend on the unit selected.

7. Dust - Dust would potentially be generated from excavation activities, material pretreatment and feeding as well as handling of treated soils. Dust suppression technologies would need to be implemented to address this concern.

8. Hours of Operation - LTTD units typically operate best if a constant temperature is maintained. Vendors recommend that the systems be run 24 hours per day to maximize performance of the unit and to optimize the economics. Operations around the clock would extend the noise, dust, traffic and other concerns into hours that residents would typically be home. To abate this concern, it would be necessary to start and stop the unit each day, thus introducing temperature cycling of the equipment and greatly reducing efficiency.

9. Corrosion - Corrosion has been a problem at other LTTD systems that handled chlorinated organics. Corrosion leads to downtime and increases the possibility of a release. Hydrochloric acid is a decomposition product from the process. This acid attacks carbon steel. It would probably be necessary to design and modify a system to be constructed of stainless steel in order to handle these materials. This is non-standard construction. Stainless steel is typically very expensive relative to carbon steel.

10. Sulfur Explosions - At least two other LTTD units we have identified have had problems with sulfur explosions in the baghouse. The materials at Pulverizing Services contain high levels of sulfur, as evidenced by visible granules in areas of the site. The Pulverizing Services facility handled large volumes of sulfur and iron pyrites during its operating history. One vendor claims that this problem can be eliminated by pre-treatment of the materials to remove sulfur. PPG is not familiar with the appropriate technology to perform the pre-treatment. In any event, pretreatment increases the complexity of the operations and aggravates other concerns identified here.

11. Equipment Reliability - In discussing LTTD with other parties, we have been made aware of periods of significant downtime and feed system problems. As discussed above, we have concerns about the potential operational difficulty of operating the emissions control systems. PPG is a major industrial organization with significant experience in operating all types of mechanical equipment. From our experience, we know that equipment does fail and that complex systems require a significant amount of care and maintenance. We are not confident about our ability to provide this degree of care at a site at which we do not have a significant operating presence.

12. Disposal of waste products - Operation of an LTTD system may in fact generate hazardous wastes from contaminated soils that are currently non-hazardous by concentrating hazardous substances. As discussed above, byproducts may also be formed. In addition, streams such as spent carbon or waste water would need to be handled even if not hazardous. These factors would potentially serve to increase costs and complexity as opposed to other approaches.

13. Space requirements - Space requirements vary from system to system and depend on ancillary facilities. It has been estimated that a 200' x 200' area would be required. Due to the number of buildings and contaminated areas, it appears that the only areas that would provide sufficient space of set up a system would be in Area C, an unimpacted area of the property, or Area B, which would necessitate transporting most of the contaminated soils across New Albany Road. Either alternative is unattractive due to possible spreading of contamination.

14. Heterogeneous mix - The trench materials appear to be a heterogeneous mix. LTTD works best when a set of operating conditions (time and temperature) can be optimized for a contaminated soil matrix. The heterogeneous mix may mean that while conditions can be set for an average or composite of soils, occasionally a slug of material may get into the unit that cannot be treated sufficiently, or worse, may create an operating excursion, such as a fire or pressure surge.

15. Infrastructure Requirements - Depending on the system selected, it may be necessary to provide water supply, water discharge, electricity, natural gas, and possibly other site improvements to support the LTTD operation.

16. Need for Treatment - It is unclear whether there is any benefit or need to treat the wide majority of contaminated soils that are relatively less impacted, particularly when they are not hazardous wastes. The need for treatment of more highly contaminated soils with LTTD would depend on the volumes of those soils and on the available alternatives.

17. Pre-conditioning of Materials - It may be necessary to pretreat materials excavated from below the water table in order to handle them through the system. Desiccants such as limestone may be needed to give adequate handling characteristics. In addition, it may be necessary to premix materials to ensure a relatively consistent flow through the system. Finally, it may be necessary to pre-treat for sulfur to reduce the chance for baghouse fires.

In summary, PPG has thoroughly evaluated the Low Temperature Thermal Desorption technology and its potential application at the Pulverizing Services site. We have identified a number of concerns as described above. It is possible there are other issues we are not aware of. There are a number of alternative technologies that could be implemented to address site soils.

If you would like to discuss this issue in more detail, please call.

Sincerely,

Thomas J. Ebbert

Thomas J. Ebbert

Appendix A

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Appendix A

Response Measure 2 - Excavation and Consolidation of All Soils into Trench Area; RCRA Cap Hazardous Waste, Soil/Asphalt Cover Remaining oils

Item	Unit Cost	Unit	Number	Scenario Costs	Comments
·ITAL COST					
·air Security Fence	6,000		1	6,000	
ormwater Management	0.12	gal	57,000	6,800	
te Clearing	3,500		1	3,500	
Mobilization / Demobilization	11,250		1	11,250	
Decon Area	4,500		1	4,500	
‹cavating & Material Handling	35,000		1	35,000	1 trackhoe, 1 loader, 1 operator, 2 laborers 1 manager, 8 weeks
Backfill & Material Handling	25	ton	8,600	250,000	Consolidation of Areas A, B, and C into Area A trench
·aging Area	11,250			11,250	7,500 sq. ft. HDPE lined w/ 1/4' gravel
·il Sampling	170	sample	310	52,700	perimeter and bottom sampling
RCRA Cap Over Trench Area	8.50	sq. ft.	28,000	250,000	80' X 350' trench area
Soil / Asphalt Cap Over Remaining Area	5.25	sq. ft	44,000	431,000	2' soil cap outside of trench in Area A
·eeding	1,850	acre	5	9,250	
·ngineering and Design				267,813	25% Capital Costs over a 2 year period
			Sub-Total Capital Cost	1,339,063	
PERATIONS & MAINTENANCE					
Maintenance	4,000		1	4,000	
Watering	70	acre	60	4,200	5 acres watered 12 times / year
owing	19	acre	60	1,140	5 acres mowed 12 times / year
·igineering				2,335	25% O & M costs
			Sub - Totals O & M	11,675	
			Present Worth	21,709	2 years at 5 %
·ER. & MAINT. for Soil Cap					
Mowing	19	acre	24	456	2 acres mowed at 12 times / year
·atering	70	acre	24	1,680	2 acres watered 12 times / year
· Top Soil Replacement	55	tons	550	30,250	every 10 years (i.e. 10, 20 30 years)
·Re-grading of Cap	2.67	tons	550	2,069	every 10 years (i.e. 10, 20 30 years), dozer
Revegatation - Entire Cap	1,850	acre	1	1,850	every 10 years (i.e. 10, 20 30 years)
·ap Inspection	3,600		1	3,600	Bi-monthly inspection of cap for cracking and erosion
·ngineering - Yearly				1,434	25 % of O & M Cost
Engineering - every 10 Years				8,542	25 % of O & M Cost
			Present Worth of Yearly Maintenance	110,220	30 years at 5%
			Present Worth of 10-Year Maintenance	52,200	30 years at 5%
			GRAND TOTALS	1,523,192	
			10 % Contingency	1,675,511	
			15 % Contingency	1,751,670	

* Volumes based on 8,600 tons to be consolidated in Area A Trench
' Soil / Asphalt Cap based on 500 ' X 100' area

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Response Measure 3A - Excavation; On-site Ex-situ Anaerobic Bioremediation, Offsite Landfilling and Incineration

				Scenario Costs ($)			
			Scenario Description	Low	Medium	High	
			% Bio. Treat. / Landfill / Incinerate	5 / 90 / 5	10 / 80 / 10	10 / 70 / 20	
Item	Unit Cost	Unit	Number				Comments
TAL COST							
Repair Security Fence	6,000		*	6,000	6,000	6,000	
ormwater Management	0.12	gal.	57,000	6,800	6,800	6,800	
e Clearing	3,500		1	3,500	3,500	3,500	
Mobilization / Demobilization	11,250		*	11,250	11,250	11,250	
con Area	4,500		*	4,500	4,500	4,500	
cavating & Material Handling	60,000		*	60,000	60,000	60,000	1 trackhoe 1 loader 1 operator 2 laborers 1 manager, 8 weeks, 13,000 tons
ckfill & Material Handling	25	ton	12,445 / 11,790 / 11,790	371,125	354,750	354,750	Landfill and Incineration soils only
Staging Area	11,250			11,250	11,250	11,250	7,500 sq. ft., HDPE lined w/ 1/4' gravel
Soil Sampling	170	sample	310	52,700	52,700	52,700	perimeter and bottom sampling
Ex-situ Biological Treatment	140	ton	655 / 1,310 / 1,310	453,580	657,160	707,160	unit costs for treatability studies (200K / 250K / 300K), site security for 2 yrs (100K), analytical for 2 yrs (1 sample / 2 weeks; 100 ton / soil piles, $170 / sample)
nsulting Fee**	250,000		*	250,000	250,000	250,000	
Biological Treatment Material Handling	10	tons	655 / 1,310 / 1,310	6,550	13,100	13,100	2 years
ndfill	55	ton	11,790 / 10,480 / 9,170	648,450	576,400	504,350	transportation included
Incinerate	800	ton	655 / 1,310 / 2,620	524,000	1,048,000	2,096,000	$0.40 per pound, transportation included
eding	1,850	acre	5	9,250	9,250	9,250	
gineering and Design				604,739	766,165	1,022,653	25% Capital Costs over a 2 year period
			Sub-Total Capital Cost	3,023,694	3,830,825	5,113,263	
RATIONS & MAINTENANCE							
tenance	4,000		1	4,000	4,000	4,000	
Watering	70	acre	60	4,200	4,200	4,200	5 acres watered 12 times / year
Mowing	19	acre	60	1,140	1,140	1,140	5 acres mowed 12 times / year
gineering				2,335	2,335	2,335	25% O & M costs
			Sub - Totals O & M	11,675	11,675	11,675	
			Present Worth	21,709	21,709	21,709	2 years at 5 %
			GRAND TOTALS	3,045,402	3,852,534	5,134,971	
			10 % Contingency	3,349,943	4,237,787	5,648,468	
			15 % Contingency	3,502,213	4,430,414	5,905,217	

* Volumes based on 13,100 tons

** Zeneca Consulting Fee is based on a preliminary assumption; cost is subject to change.

400138

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Response Measure 3B - Excavate and Consolidate Soils in Area A Trench with Soil Cover; On-site Ex-situ Anaerobic Bioremediation, and Offsite Landfilling and Incineration

				Scenario Costs ($)			
			Scenario Description	Low	Medium	High	
			% Bio. Treat. / Landfill / Incinerate	5 / 90 / 5	10 / 80 / 10	10 / 70 / 20	
Item	**Unit Cost**	**Unit**	**Number**				**Comments**
CAPITAL COST							
Repair Security Fence	6 000		1	6 000	6 000	6 000	
Stormwater Management	0 12	gal	57 000	6 800	6 800	6 800	
Site Clearing	3 500		1	3 500	3 500	3 500	
Mobilization / Demobilization	11 250		1	11 250	11 250	11 250	
Decon Area	4 500		1	4 500	4 500	4 500	
Excavating & Material Handling of Soils > the RA 10^-6 Construction Worker Criteria	35 000		8 800 tons	35 000	35 000	35 000	1 trackhoe 1 loader 1 operator 2 laborers 1 manager 8 weeks
Excavating & Material Handling of Soils > the RA 10^-6 Commercial Site Worker Criteria but < the RA 10^-6 Construction Site Worker Criteria and Consolidated into Area A Trench	30 000		4 300 tons	30 000	30 000	30 000	1 trackhoe 1 loader 1 operator 1 laborers 1 manager 8 weeks
Backfill of Areas A B and C Excavations and Remainder of Trench Includes Material Handling Costs	25	ton	8 800	255 000	255 000	255 000	
Staging Area	11 250			11 250	11 250	11 250	7 500 sq ft HDPE lined w/ 1/4 gravel
Soil Sampling	170	sample	100	17 000	17 000	17 000	perimeter and bottom sampling
Ex-situ Biological Treatment	140	ton	440 / 880 / 880	405 800	552 760	602 760	unit costs for treatability studies 200K 250K 300K) site security for 2 yrs (100K analytical for 2 yrs (1 sample / 2 weeks 100 ton soil piles $170 / sample)
Consulting Fee****	250 000		1	250 000	250 000	250 000	
Bio Treat Material Handling	10	ton	440 / 880 / 880	4 400	8 800	8 800	2 years
Landfill	55	ton	7 920 / 7 040 / 6 160	435 600	387 200	338 800	transportation included
Incinerate	800	ton	440 / 880 / 1760	352 000	704 000	1 408 000	$0 40 per pound transportation included
Soil Cover / Asphalt Cap	25	ton	3 750	93 750	343 750	343 750	500' X 100' Area A trench only with clay backfill extra excavated areas only
Seeding	1 850	acre	5	9 250	9 250	9 250	
Engineering and Design				482 775	659 015	835 415	25% Capital Costs over a 2 year period
			Sub-Total Capital Cost	2 413 875	3 295 075	4 177 075	
OPERATIONS & MAINTENANCE							
Maintenance	4 000		1	4 000	4 000	4 000	
Watering	70	acre	60	4 200	4 200	4 200	5 acres watered 12 times / year
Mowing	19	acre	60	1 140	1 140	1 140	5 acres mowed 12 times / year
Engineering				2 335	2 335	2 335	25% of O & M Costs
			Sub - Totals O & M	11 675	11 675	11 675	
			Present Worth	21 709	21 709	21 709	2 years at 5 %
OPER. & MAINT. for Soil Cap							
Mowing	75	acre	24	1 800	1 800	1 800	Mow 2 acres 12 times / year
Watering	70	acre	2	140	140	140	
30 % Top Soil Replacement	55	tons	1 150	63 250	63 250	63 250	every 10 years (i e 10 20 30 years)
6" Re-grading of Cap	2 67	tons	1 150	3 671	3 671	3 671	every 10 years (i e 10 20 30 years) dozer compactor with mobilization
Revegetation - Entire Cap	1 850	acre	2	3 700	3 700	3 700	every 10 years (i e 10 20 30 years)
Cap Inspection	3 600		1	3 600	3 600	3 600	Bi-monthly inspection of cap for cracking and erosion
Engineering - Yearly				1 385	1 385	1 385	25 % of O & M Cost
Engineering - every 10 Years				17 655	17 655	17 655	25 % of O & M Cost
			Present Worth of Yearly Maintenance	106 454	106 454	106 454	30 years at 5%
			Present Worth of 10-Year Maintenance	107 889	107 889	107 889	30 years at 5%
OPER. & MAINT. for Asphalt Cap							
Cap Inspection	1200		1	1 200	1 200	1 200	2 / year for cracks
Seal Cracks 25% from years 5-8 50% from 9-12 75% from 13-16 100% from 17-20	0 75	ft	25 / 50 / 75 /100 Percent	375 000	375 000	375 000	Percentages based on total area of asphalt cap assumes no traffic on cap and a liner beneath asphalt linear feet 12 5K 25K 37 5K 50K respectively
Patch 10% from years 21-29 Seal 25% from 1-29	6 70 / 0 75	sq yrd / ft	10 / 25 Percent	118 143	118 143	118 143	Percentages based on total area of asphalt cap assumes no traffic on cap and a liner beneath asphalt Patch Area 5 000 sq ft Cracks 12 5K ft
Cap Reconstruction year 30	5	sq ft	50 000	250 000	250 000	250 000	
Engineering - every 10 Years				186 086	186 086	186 086	25 % of O&M Costs including Capital
			Present Worth	486 686	486 686	486 686	30 years at 5%
			Grand Totals	**2,649,927**	**3,803,469**	**4,685,469**	
			10 % Contingency	**2,914,919**	**4,183,816**	**5,154,016**	
			15 % Contingency	**3,047,416**	**4,373,990**	**5,388,290**	

On-Site Volume of Impacted Soils is 13,100 tons

** Assume: 8,800 tons of Soils > RA 10^-6 Construction Worker Criteria for treatment and off-site disposal

*** Assume: Remaining 4,300 tons of Soils > RA 10^-6 Commercial Site Worker Criteria for consolidation and capping in the Area A Trench Area

**** Zeneca Consulting Fee is based on a preliminary assumption; cost is subject to change.

***** Soil / Asphalt Cap based on 500 ' X 100' area

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Response Measure 4A - Excavation; Offsite LTTD, Landfilling, and Incineration

				Scenario Costs ($)			
			Scenario Description	Low	Medium	High	
			% LTTD / Landfill / Incinerate	5 / 90 / 5	10 / 80 / 10	10 / 70 / 20	
Item	Unit Cost	Unit	Number				Comments
ITAL COST							
Repair Security Fence	6,000		1	6,000	6,000	6,000	
ormwater Management	0.12	gal	57,000	6,800	6,800	6,800	
..e Clearing	3,500		1	3,500	3,500	3,500	
Mobilization / Demobilization	11,250		1	11,250	11,250	11,250	
:con Area	4,500		1	4,500	4,500	4,500	
Excavating & Material Handling	60,000		1	60,000	60,000	60,000	1 trackhoe, 1 loader, 1 operator, 2 laborers, 1 manager, 8 weeks, 13,000 tons
ckfill & Material Handling	25	ton	12,445 / 11,790 / 11,790	371,125	354,750	354,750	Soils treated by LTTD are transported back to site for backfill
Staging Area	11,250			11,250	11,250	11,250	7,500 sq. ft., HDPE lined w/ 1.4' gravel
il Sampling	170	sample	310	52,700	52,700	52,700	perimeter and bottom sampling
..TD	100	ton	655 / 1,310 / 1,310	190,500	256,000	256,000	Pilot Test 75K, LTTD analytical 50K
TD Material Handling	210	tons	655 / 1,310 / 1,310	197,550	335,100	335,100	$0.10 / pound transportation back to site and backfill
Landfill	55	ton	11,790 / 10,480 / 9,170	648,450	576,400	504,350	transportation included
Incinerate	800	ton	655 / 1,310 / 2,620	524,000	1,048,000	2,128,000	$0.40 per pound; transportation included
eding	1,850	acre	5	9,250	9,250	9,250	
gineering and Design				524,219	683,875	935,863	25% Capital Costs over a 2 year period
			Sub-Total Capital Cost	2,621,094	3,419,375	4,679,313	
RATIONS & MAINTENANCE							
..intenance	4,000		1	4,000	4,000	4,000	
Watering	70	acre	60	4,200	4,200	4,200	5 acres watered 12 times / year
Mowing	19	acre	60	1,140	1,140	1,140	5 acres mowed 12 times / year
gineering				2,335	2,335	2,335	25% O & M costs
			Sub - Totals O & M	11,675	11,675	11,675	
			Present Worth	21,709	21,709	21,709	2 years at 5 %
			GRAND TOTALS	2,642,802	3,441,084	4,701,021	
			10 % Contingency	2,907,083	3,785,192	5,171,123	
			15 % Contingency	3,039,223	3,957,246	5,406,174	

'olumes based on 13,100 tons

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Response Measure 4B - Excavate and Consolidate Soils in Area A Trench with Soil Cover: Offsite LTTD, Landfilling, and Incineration

Item	Unit Cost	Unit	Number	Low	Medium	High	Comments
			Scenario Costs ($)				
			Scenario Description	Low	Medium	High	
			% LTTD / Landfill / Incinerate	5 / 90 / 5	10 / 80 / 10	10 / 70 / 20	
CAPITAL COST							
Repair Security Fence	6 000		1	6 000	6 000	6 000	
Stormwater Management	0.12	ga	57 000	6 800	6 800	6 800	
Site Clearing	3 500		1	3 500	3 500	3 500	
Mobilization / Demobilization	11 250		1	11 250	11 250	11 250	
Decon Area	4 500		1	4 500	4 500	4 500	
Excavating & Material Handling of Soils > the RA 10^-6 Construction Worker Criteria	35 000		8 800 tons	35 000	35 000	35 000	1 trackhoe 1 loader 1 operator 2 laborers 1 manager 8 weeks
Excavating & Material Handling of Soils > the RA 10^-6 Commercial Site Worker Criteria but < the RA 10^-6 Construction Site Worker Criteria and Consolidated into Area A Trench	30 000		4 300 tons	30 000	30 000	30 000	1 trackhoe 1 loader 1 operator 1 laborers 1 manager 8 weeks
Backfill of Area A B and C Excavations and Remainder of Trench Includes Material Handling Costs	25	ton	8 800	255 000	255 000	255 000	1 700 tons from areas B and C 8 300 tons from outlying portions of Area A
Staging Area	11 250			11 250	11 250	11 250	7 500 sq ft HDPE lined w/ 1/4' gravel
Soil Sampling	170	sample	100	17 000	17 000	17 000	perimeter and bottom sampling
Off-site LTTD Treatment	100	ton	440 / 880 / 880	169 000	213 000	213 000	Pilot test 75K LTTD analytical 50K
Post LTTD Material Handling	210	ton	440 / 880 / 880	122 400	214 800	214 800	$0.10 / pound transportation back to site and backfill
Landfill	55	ton	7 920 / 7 040 / 6 160	435 600	387 200	338 800	transportation included
Incinerate	800	ton	440 / 880 / 1760	352 000	704 000	1 408 000	$0.40 per pound transportation included
Soil Cover / Asphalt Cap	5	sq ft	50 000	250 000	500 000	500 000	500' X 100' Area A trench only with clay backfill extra excavated areas only Asphalt cover for the highest Scenario only
Seeding	1 850	acre	5	9 250	9 250	9 250	
Engineering and Design				429 638	602 138	766 038	25% Capital Costs over a 2 year period
			Sub-Total Capital Cost	2 148 188	3 010 688	3 830 188	
OPERATIONS & MAINTENANCE							
Maintenance	4 000		1	4 000	4 000	4 000	
Watering	70	acre	60	4 200	4 200	4 200	5 acres watered 12 times / year
Mowing	19	acre	60	1 140	1 140	1 140	5 acres mowed 12 times / year
Engineering				2 335	2 335	2 335	25% of O & M Costs
			Sub - Totals O & M	12 800	12 800	12 800	
			Present Worth	23 800	23,800	23 800	2 years at 5 %
OPER. & MAINT. for Soil Cap							
Mowing	75	acre	24	1 800	1 800	1 800	Mow 2 acres 12 times / year
Watering	70	acre	2	140	140	140	
10 % Top Soil Replacement	55	tons	1 150	63 250	63 250	63 250	every 10 years (i.e. 10, 20 30 years)
Re-grading of Cap	2 67	tons	1 150	3 671	3 671	3 671	every 10 years (i.e. 10, 20 30 years) dozer compactor with mobilization
Revegatation - Entire Cap	1 850	acre	2	3 700	3 700	3 700	every 10 years (i.e. 10, 20 30 years)
Cap Inspection	3,600		1	3 600	3 600	3 600	Bi-monthly inspection of cap for cracking and erosion
Engineering - Yearly				1 385	1 385	1 385	25 % of O & M Cost
Engineering - every 10 Years				17 655	17 655	17 655	25 % of O & M Cost
			Present Worth of Yearly Maintenance	106 454	106 454	106 454	30 years at 5%
			Present Worth of 10-Year Maintenance	107 889	107,889	107 889	30 years at 5%
OPER. & MAINT. for Asphalt Cap							
Cap Inspection	1200		1	1 200	1 200	1 200	2 / year for cracks
Seal Cracks 25% from years 5-8 50% from 9-12 75% from 13-16 100% from 17-20	0 75	ft	25 / 50 / 75 / 100 Percent	375 000	375 000	375 000	Percentages based on total area of asphalt cap assumes no traffic on cap and a liner beneath asphalt linear feet 12 5K 25K 37 5K 50K respectively
Patch 10% from years 21-29 Seal 25% from -29	6 70 / 0 75	sq yd / ft	10 / 25 Percent	118 143	118 143	118 143	Percentages based on total area of asphalt cap assumes no traffic on cap and a liner beneath asphalt Patch Area 5 000 sq ft Cracks 12 5K ft
Cap Reconstruction year 30	5	sq ft	50 000	250 000	250 000	250 000	
Engineering - every 10 Years				186 086	186 086	186 086	25 % of O&M Costs including Capital
			Present Worth	486 686	486 686	486 686	30 years at 5%
			Grand Totals	**2,386,331**	**3,521,174**	**4,340,674**	
			10 % Contingency	**2,624,964**	**3,873,291**	**4,774,741**	
			15 % Contingency	**2,744,281**	**4,049,350**	**4,991,775**	

* On-Site Volume of Impacted Soils is 13,100 tons

** Assume: 8,800 tons of Soils > RA 10^-6 Construction Worker Criteria for off-site treatment and disposal

** Assume: Remaining 4,300 tons of Soils > RA 10^-6 Commercial Site Worker Criteria for consolidation and capping in the Area A Trench Area

* Soil / Asphalt Cap based on 500 ' X 100' area

12/3/97
8 23 AM

400141

Response Measure 5A - Excavation; Offsite Landfilling and Incineration

Item	Unit Cost	Unit	Number	Low	Medium	High	Comments
			Scenario Costs ($)				
			Scenario Description	Low	Medium	High	
			% Landfill / Incinerate	90 / 10	80 / 20	70 / 30	
... TAL COST							
R..pair Security Fence	6,000		1	6,000	6,000	6,000	
... rmwater Management	0.12	gal.	57,000	6,800	6,800	6,800	
Site Clearing	3,500		1	3,500	3,500	3,500	
Mobilization / Demobilization	11,250		1	11,250	11,250	11,250	
... con Area	4,500		1	4,500	4,500	4,500	
Excavating & Material Handling	60,000		1	60,000	60,000	60,000	1 trackhoe 1 loader, 1 operator 2 laborers 1 manager, 8 weeks 13,000 tons
... ckfill & Material Handling	25	ton	13,100	387,500	387,500	387,500	
... ging Area	11,250			11,250	11,250	11,250	7,500 sq ft HDPE lined w 1/4 gravel
Soil Sampling	170	sample	310	52,700	52,700	52,700	perimeter and bottom sampling
... ndfill	55	ton	11,790 / 10,480 / 9,170	648,450	576,400	504,350	transportation included
Incinerate	800	ton	1,310 / 2,620 / 3,930	1,048,000	2,096,000	3,144,000	$0.40 per pound, includes transportation costs
... eding	1,850	acre	5	9,250	9,250	9,250	
... gineering and Design				562,300	806,288	1,050,275	25% Capital Costs over a 2 year period
			Sub-Total Capital Cost	2,811,500	4,031,438	5,251,375	
... ERATIONS & MAINTENANCE							
M...intenance	4,000		1	4,000	4,000	4,000	
Watering	70	acre	60	4,200	4,200	4,200	5 acres watered 12 times / year
M..wing	19	acre	60	1,140	1,140	1,140	5 acres mowed 12 times / year
E... gineering				2,335	2,335	2,335	25% O & M Costs
			Sub - Totals O & M	11,675	11,675	11,675	
			Present Worth	21,709	21,709	21,709	2 years at 5 %
			GRAND TOTALS	**2,833,209**	**4,053,146**	**5,273,084**	
			10 % Contingency	3,116,529	4,458,461	5,800,392	
			15 % Contingency	3,258,190	4,661,118	6,064,046	

* Volumes based on 13,100 tons

12/3/97
8 23 AM

400142

Response Measure 5B - Excavate and Consolidate Soils Below Construction Worker 10^-6 Criteria into Area A Trench with Soil Cover; Off-site Landfilling and Incineration of Soils Above Construction Worker 10^-6 Criteria

Item	Unit Cost	Unit	Number	Scenario Costs ($) Low	Medium	High	Comments
			Scenario Description	Low	Medium	High	
			% Landfill / Incinerate	90 / 10	80 / 20	70 /30	
·AL COST							
·air Security Fence	6 000		1	6 000	6 000	6 000	
·rmwater Management	0 12	gal	57 000	6 800	6 800	6 800	
· Clearing	3 500		1	3 500	3 500	3 500	
Mobilization / Demobilization	11 250		1	11 250	11 250	11 250	
·tion Area	4 500		1	4 500	4 500	4 500	
·avating & Material Handling of Soils > the RA ·6 Construction Worker Criteria	35 000		8 800 tons	35 000	35 000	35 000	1 trackhoe 1 loader 1 operator 2 laborers 1 manager 8 weeks
Excavating & Material Handling of Soils > the RA 10^-6 Commercial Site Worker Criteria but < the 10^-6 Construction Site Worker Criteria and ·solidated into Area A Trench	30 000		4 300 tons	30 000	30 000	30 000	1 trackhoe 1 loader 1 operator 1 laborers 1 manager 8 weeks
·kfill of Area A B and C Excavations and Remainder of Trench includes Material Handling Costs	25	ton	8 800	255 000	255 000	255 000	1 700 tons from areas B and C 6 300 tons from outlying portions of Area A
·ging Area	11 250			11 250	11 250	11 250	7 500 sq ft HDPE lined w/ 1/4' gravel
· Sampling	170	sample	100	17 000	17 000	17 000	perimeter and bottom sampling
Landfill	55	ton	7 920 / 7 040 / 6 160	435 600	387 200	338 800	includes transportation costs
·nerate	800	ton	880 / 1 760 / 2 640	704 000	1 408 000	2 112 000	$0 40 per pound includes transportation costs
Cover / Asphalt Cap	5	sq ft	50 000	500 000	500 000	500 000	500' X 100' Area A trench only with clay backfill extra excavated areas only Asphalt cover for worst-case Scenario only
·ding	1 850	acre	5	9 250	9 250	9 250	
Engineering and Design				507 288	671 188	835 088	25% Capital Costs over a 2 year period
			Sub-Total Capital Cost	2 536 438	3 355 938	4 175 438	
·ER. & MAINT.							
Maintenance	4 000		1	4 000	4 000	4 000	
Watering	70	acre	60	4 200	4 200	4 200	5 acres watered 12 times / year
·ng	75	acre	60	4 500	4 500	4 500	5 acres mowed 12 times / year
·eering				3 175	3 175	3 175	25% of O & M Costs
			Sub - Totals O & M	15 875	15 875	15 875	
			Present Worth	29 518	29 518	29 518	2 years at 5 %
·ER. & MAINT. for Soil Cap							
·wing	75	acre	24	1 800	1 800	1 800	Mow 2 acres 12 times / year
·tering	70	acre	2	140	140	140	
30 % Top Soil Replacement	55	tons	1 150	63 250	63 250	63 250	every 10 years (i e 10 20 30 years)
Re-grading of Cap	2 67	tons	1 150	3 671	3 671	3 671	every 10 years (i e 10 20 30 years) dozer compactor with mobilization
·egatation - Entire Cap	1 850	acre	2	3 700	3 700	3 700	every 10 years (i e 10 20 30 years)
Cap Inspection	3 600		1	3 600	3 600	3 600	Bi-monthly inspection of cap for cracking and erosion
·gineering - yearly				1 385	1 385	1 385	25 % of O & M Cost
·neering - every 10 Years				17 655	17 655	17 655	25 % of O & M Cost
			Present Worth of Yearly Maintenance	106 454	106 454	106 454	30 years at 5%
			Present Worth of 10-Year Maintenance	107 889	107 889	107 889	30 years at 5%
·ER. & MAINT. for Asphalt Cap							
· Inspection	1200		1	1 200	1 200	1 200	2 / year for cracks
Seal Cracks 25% from years 5-8 50% from 9-12 75% from 13-16 100% from 17-20	0 75	ft	25 / 50 / 75 /100 Percent	375 000	375 000	375 000	Percentages based on total area of asphalt cap assumes no traffic on cap and a liner beneath asphalt linear feet 12 5K 25K 37 5K 50K respectively
·ch 10% from years 21-29 Seal 25% from 21-29	6 70 / 0 75	sq yrd / ft	10 / 25 Percent	118 143	118 143	118 143	Percentages based on total area of asphalt cap assumes no traffic on cap and a liner beneath asphalt Patch Area 5 000 sq ft Cracks 12 5K ft
Cap Reconstruction year 30	5	sq ft	50 000	250 000	250 000	250 000	
·neering - every 10 Years				186 086	186 086	186 086	25 % of O&M Costs including Capital
			Present Worth	486 686	486 686	486 686	30 years at 5%
			GRAND TOTALS	**3,052,641**	**3,872,141**	**4,691,641**	
			10 % Contingency	**3,357,906**	**4,259,356**	**5,160,806**	
			15 % Contingency	**3,510,538**	**4,452,963**	**5,395,388**	

·te Volume of Impacted Soils is 13,100 tons
·sume: 8,800 tons of Soils > RA 10^-6 Construction Worker Criteria for off-site disposal
* **Assume: Remaining 4,300 tons of Soils > RA 10^-6 Commercial Site Worker Criteria for consolidation and capping in the Area A Trench Area**
** **Soil / Asphalt Cap based on 500 ' X 100' area**

12/3/97
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400143

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SCANNING TRACKING SHEET

DOC ID # 38789

DOC TITLE/SUBJECT:

RESPONSE MEASURE 2
SELECTIVE EXCAVATION, CONSOLIDATION, AND CAPPING
FIGURE 4-1

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DOC TITLE/SUBJECT:

**RESPONSE MEASURE 3A AND 3B
EXCAVATION ON-SITE, EX-SITU ANAEROBIC BIOTREATMENT; OFF-SITE LANDFILLING / INCINERATION AND CAPPING
FIGURE 4-2**

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DOC TITLE/SUBJECT:

RESPONSE MEASURE 5A AND 5B EXCAVATION; OFF-SITE INCINERATION; OFF-SITE LANDFILLING
FIGURE 4-4

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